Railway Mechanical Engineer

Founded in 1832 as the American Rail-Road Journal
With which are also incorporated the National Car Builder, American Engineer and Railroad Journal, and Railway Master Mechanic. Name Registered, U. S. Patent Office

June, 1932

Volume 106 *No. 6*

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Published on the first Thursday of every month by the

Simmons-Boardman Publishing Company

34 Crystal Street, East Stroudsburg, Pa. Editorial and Executive Offices,
30 Church Street, New York

Chicago: 105 West Adams St.
Washington: 17th and H Streets, N. W.
Cleveland: Terminal Tower
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The Railway Mechanical Engineer is a member of the Associated Business Papers (A. B. P.) and the Audit Bureau of Circulations (A. B. C.) and is indexed by the Industrial Arts Index and also by the Engineering Index Service.

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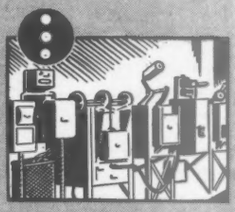

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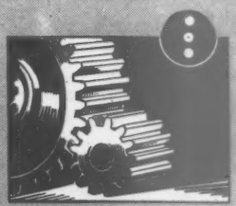

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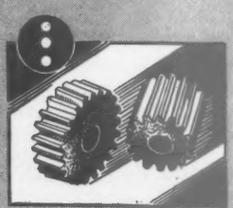

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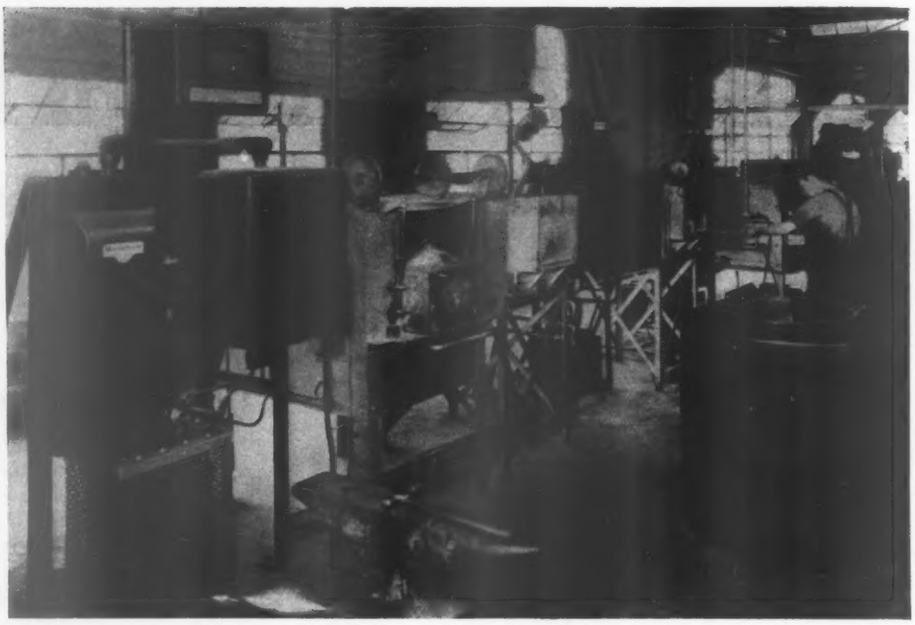

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Railway
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June - 1932

Relation of Back Pressure to Locomotive Performance

By George W. Armstrong

A discussion of improved locomotive performance and increased boiler capacity as effected by reduced back pressure and the use of the annular-ported exhaust nozzle

LOW back pressure has become a subject of general discussion in recent years and a general opening up of exhaust nozzles has been the result. In many instances low back pressure has been attained, but since no compensating change has been made in the type of exhaust nozzle to improve draft efficiency, there has been a reduction in draft which frequently has resulted in what is known as a hard-steaming locomotive.

Low back pressure in itself is well worth seeking. The back pressure on the piston acts as a brake, decreasing the work output of the locomotive and, therefore, the drawbar pull and the consequent speed-hauling ability of the locomotive. However, unless an engine is over-drafted, any opening up of the exhaust nozzle to reduce the back pressure will adversely affect combustion and, if the steaming ability of the engine is affected enough thereby, there may be no improvement in engine performance, even though low back pressure is attained.

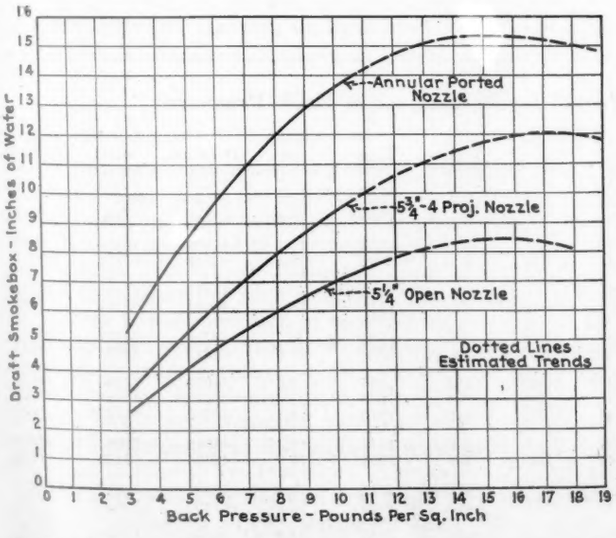

Draft Smokebox - Inches of Water
Back Pressure - Pounds Per Sq. Inch
Annular Ported Nozzle
5¾"-4 Proj. Nozzle
5¼" Open Nozzle
Dotted Lines Estimated Trends

Fig. 1—The relation between draft and back pressure for different types of nozzles and the limitations in draft production

Authentic information as to the effect produced by reducing back pressure is unfortunately meager. The locomotive test plant affords the only means for evaluating effects and all published tests have been directed toward study of a respective design of locomotive or a major locomotive appliance and, with one possible exception, develop no information which throws light on the subject of back pressure.

Pennsylvania Bulletin No. 32, covering the test of the Pennsylvania class I-1-s locomotive, a 2-10-0 type with 50 per cent restricted cut-off, with and without the open-type feedwater heater with which it was equipped, reveals some of the effects of reduced back pressure. Data selected from these tests are given in Table I. The primary interest of these data lies, first, in the establishment of the fact that reduced back pressure does result in increased drawbar pull and, second, in the apparent fact that a considerable portion of this increased drawbar pull results from a reduction in the locomotive internal resistance or friction drawbar pull, which results from reduced brake action of the back pressure rather than from any appreciable increase in cylinder output or indicated horsepower.

As seen from Table I, there is in general an increased indicated horsepower at the higher exhaust pressures while there is a very marked reduction in friction draw-

bar pull at the lower exhaust pressures. With the locomotive operating at 40 per cent cut-off, at a speed of 21.9 m.p.h., the comparison is:

Test	Exh. press., lb.	Drawbar pull, lb.	Tractive force, lb.	Frict. Drawbar pull, lb.
5946*	9	38348	51849	13127
5914	7	39328	50815	11462
5916	7	40160	51846	11660

* Test with injector.

The difference in friction drawbar pull between test 5946 and the average of tests 5914 and 5916 is 1,566 lb.

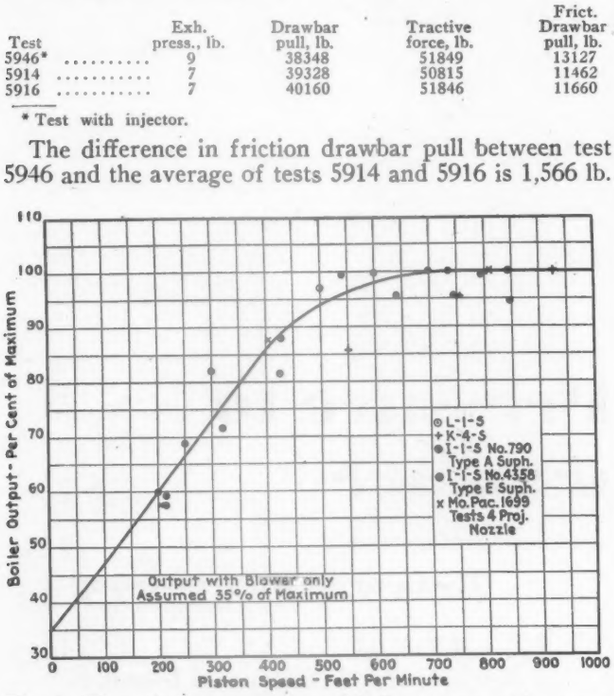

Boiler Output - Per Cent of Maximum
Piston Speed - Feet Per Minute
L-1-S
K-4-S
I-1-S No.790 Type A Suph.
I-1-S No.4358 Type E Suph.
Mo.Pac.1699 Tests 4 Proj. Nozzle
Output with Blower only Assumed 35% of Maximum

Fig. 2—The relative percentage of boiler output with respect to the maximum at various piston speeds

The horsepower difference at this speed of 21.9 m.p.h. for 2 lb. difference in exhaust pressure is as follows, assuming that as the mean effective pressure:

$$\text{H.P.} = \frac{\text{M.E.P.} \times \text{Piston Area} \times \text{Piston Speed}}{33{,}000} = \frac{2\times2\times572.56\times640}{33{,}000} = 44.4$$

$$\text{H.P.} = \frac{\text{Speed} \times \text{Tractive Force}}{375}, \text{ so T. F.} = \frac{44.4 \times 375}{21.9} = 761 \text{ lb.}$$

We see that 761 lb. of the total 1,566 lb. frictional drawbar pull results from removing the braking action of the back pressure. Presumably there is some other unaccounted for action to account for the remaining 805 lb., such as a small increase in mean effective pressure and therefore indicated horsepower, which, however, is last in reducing the area of a small indicator card.

F. A. Goodfellow, supervisor of fuel and locomotive service, Pennsylvania, in discussing a paper by R. E. Woodruff, system operating vice-president, Erie, on "Our Experience in Saving Coal," before the September, 1930, meeting of the New York Railroad Club, had this to say:

"On the effect of reducing back pressure due to increasing exhaust nozzle areas, the results referred to were taken from tests of a class I-1 locomotive having 30½-in. by 32-in. cylinders, 250 lb. boiler pressure, a 50 per cent limited cut-off, grate area of 70 sq. ft., 62-in. diameter drivers and 6,255 sq. ft. of heating surface.

"There were six tests made varying in speeds from 7.3 to 29.1 m.p.h. The nozzle referred to as standard was of the four internal projection type with an area of 33 sq. in. The nozzle used for comparison was of the multiple point type with an area of 45 sq. in. or an increase of 36 per cent.

"The total dry coal fired per hour on both sets of tests varied from 2,100 lb. to 12,800 lb. The water

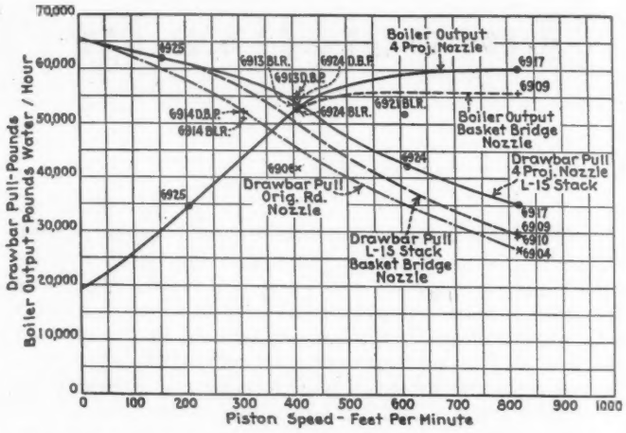

Drawbar Pull-Pounds
Boiler Output-Pounds Water / Hour
Piston Speed - Feet Per Minute
Boiler Output 4 Proj. Nozzle
Boiler Output Basket Bridge Nozzle
Drawbar Pull 4 Proj. Nozzle L-1S Stack
Drawbar Pull Orig. Rd. Nozzle
Drawbar Pull L-1S Stack Basket Bridge Nozzle

Fig. 3—The effect of various types of nozzles on drawbar pull and boiler output as revealed by tests of a three-cylinder 2-8-2 type locomotive

evaporated was between 18,000 lb. and 67,000 lb. per hour. The indicated horsepower was 800 hp. to 4,000 hp. The dynamometer horsepower from 600 hp. to 3,400 hp. With drawbar pull ranging from 31,600 lb. to 34,500 lb. and burning coal up to 3,800 lb. of dry coal per hour, there was no increase between the two

Table I—Increase in Drawbar Pull Effected by Reduction in Back Pressure

Test	Test designation	Exh. press.	Temp. exhaust	M.e.p.	Cut off per cent	Steam chest press.	Initial press.	Press. at cut off	Least back press.	I.hp. total	Water per i.hp./hr.	Drawbar pull	Tractive effect from i.hp.	Friction drawbar pull
5942*	40-20-F	2	221	86.6	21.7	247	224	168	1.4	797	20.7	29600	41958	12337
5959*	40-20-F	1	220	82.7	20.1	243	224	171	0.7	761	23.0	27469	40073	12585
5925	40-20-F	1	220	84.3	20.3	243	226	169	0.6	776	20.8	32578	40847	8248
5954*	40-30-F	2	228	117.0	30.9	246	234	179	0.6	1077	20.8	43408	56730	13291
5928	40-30-F	2	226	118.3	31.5	245	234	179	1.3	1089	19.4	46842	57335	10464
5955*	40-40-F	3	235	143.2	39.3	245	239	193	1.4	1318	20.9	54817	69415	14585
5932	40-40-F	2	232	142.6	39.8	243	236	190	0.1	1314	19.6	58837	69172	10300
5949*	80-20-F	2	221	64.7	20.6	245	208	139	2.6	1192	18.1	20258	31376	11103
5931	80-20-F	2	220	65.5	20.6	243	203	137	1.5	1228	17.6	25315	32324	6992
5945*	80-30-F	4	229	97.4	31.7	244	223	148	3.6	1794	16.0	34078	47240	13137
5960*	80-30-F	3	230	91.8	29.9	243	223	149	2.9	1689	18.2	32792	44480	11667
5926	80-30-F	3	228	98.6	31.6	241	224	149	2.1	1815	16.8	39597	47782	8161
5952*	80-40-F	6	241	121.4	40.7	241	232	157	3.9	2235	16.4	45812	58854	13010
5919	80-40-F	5	235	122.1	39.4	240	234	160	3.0	2248	15.9	49794	59188	9363
5953*	80-50-F	10	286	147.4	50.1	241	237	176	6.3	2715	16.8	57994	71495	13463
5927	80-50-F	7	259	150.1	50.5	242	236	175	4.0	2766	16.8	63263	72821	9521
5946*	120-40-F	9	256	106.2	40.1	242	218	148	10.0	2933	14.9	38348	51849	13127
5914	120-40-F	7	241	104.8	40.0	238	219	145	8.0	2895	15.5	39328	50815	11462
5916	120-40-F	7	243	106.9	41.1	242	222	142	7.0	2954	15.8	40160	51846	11660
5971	120-40-F	7	242	104.5	40.3	241	215	144	8.4	2895	15.6	43515	49290	5814

* Test with injector—others with open-type feed water heater.

nozzles, although the decrease in back pressure ranged between 30 and 40 per cent.

"When the locomotive was worked at 14.6 miles per hour and full cut-off, the increase in drawbar pull was 5.4 per cent with a reduction in back pressure of 31 per cent in favor of the large nozzle. At 21.9 miles per hour and full stroke, the increase in drawbar pull was 6.4 per cent with 37 per cent decrease in back pressure in favor of the large nozzle. At the maximum rate for operating the locomotive, or 29.1 miles per hour and full stroke, with a dry coal per hour rate of 12,000 lb. and evaporating between 65,000 lb. and 67,000 lb. of water per hour, the increase in drawbar pull was 11.5 per cent with a reduction of 32 per cent in back pressure

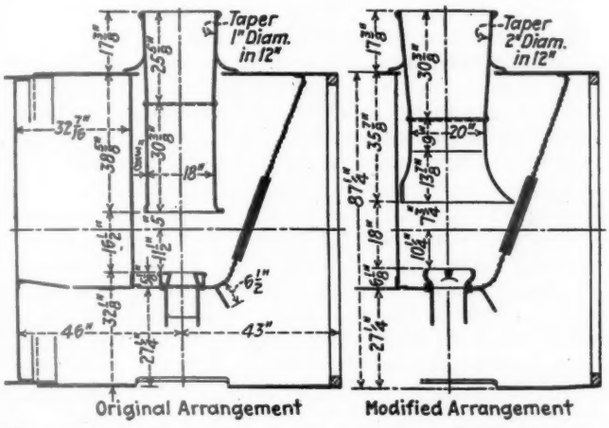


Fig. 4—Modifications necessary in a U.S.R.A. Mikado type locomotive for the application of an annular-ported nozzle

in favor of the large nozzle. These tests showed there was practically no difference in the dry coal or dry steam per indicated or dynamometer horsepower with the two different nozzles."

The tests run in 1899 by Don Sweney through joint co-operation of the University of Illinois and the Illinois Central railroad show the following improvement on a Mogul type locomotive with 19-in. by 26-in. cylinders:

Speed in m.p.h.	12	30	36
Cut-off, ins. of stroke	10	8	8
Mean effective pressure:			
Head end.			
Large tip, 19.6 sq. in.	84.12	45.39	47.66
Small tip, 15.9 sq. in.	80.42	41.60	42.40
Gain, lbs. per sq. in.	3.70	3.69	5.26
Per cent gain, m.e.p.	4.6	8.9	12.41
Crank end:			
Large tip	86.95	47.28	46 8
Small tip	83.28	42.74	42.2
Gain, lb. per sq. in.	3.67	4.54	4.60
Per cent gain, m.e.p.	4.5	9.76	11.65

The relation between back pressure and draft, or as it may be termed the draft efficiency, is fully discussed in an article on improving draft efficiency which was published on page 499 of the September, 1930, issue of the *Railway Mechanical Engineer*. Fig. 1 illustrates a typical chart showing such relation. It is evident if the steam flow per square inch of nozzle area is reduced, as would occur if nozzle area were enlarged, resulting in a decrease in back pressure, that without change in the type of nozzle, there would be a reduction in draft produced. Draft requirements increase with increase in combustion demands as the engine is worked harder and the steam demands are therefore increased.

Maximum boiler capacity of a locomotive is dependent upon the ability to supply adequate draft for combustion, and the transfer of heat released through radiation, conduction and convection in evaporating water and superheating the steam. The better the efficiency of the draft-producing medium, the greater the maximum draft that can be produced and consequently the higher the combustion rate that can be sustained. Higher combustion rates, resulting in greater heat release per cubic foot of firebox volume, mean higher firebox and gas temperatures and, with the ability to support these higher combustion rates, the maximum limit to boiler capacity becomes the ability to utilize this heat release through heat transfer in evaporating water and superheating steam, i.e. steam production.

The maximum boiler capacity has an important bear-

Table II—Improvement in Boiler Output and Consequent Locomotive Output, Effected by Redrafting—Missouri Pacific Three-Cylinder 2-8-2 Locomotive

Test	Test designation	Piston speed, ft. per min.	Evaporation moist steam per hour	Drawbar pull	I.hp.	Least back press.	Tractive force on m.e.p.
Original front end arrangement—6¼ in. open type nozzle							
6906	80-50-F	408	28445	41154	1863	..	.....
6904	160-43-F	816	42799	26918	2501	13	31206
P. R.R L-1-s stack—7-in. basket bridge type nozzle							
6914	60-80-F	306	51924	52202	2225	6	55524
6913	80-81-F	408	53924	55403	2356	7	58793
6909	160-50-F	816	55768	29788	2677	14	33402
6910	160-50-F	...	47148	29883	2643	9	32976
P. R.R. L-1-s stack—7-in. four-projection type nozzle							
6925	40-85-F	204	34504	61847	1364	1	68076
6924	80-81-F	408	52616	54088	2356	8	58793
6921	120-59-F	612	51974	42330	2752	11	45873
6917	160-60-F	816	59920	35488	3141	17	39191
6916	160-50-F	816	48925	32112	2868	12	35785
6926	160-60-F	816	61680	35375	3117	17	38892

Limit of evaporation reached:
6¼-in. open type nozzle—48,000 lb. per hr.
7-in. basket bridge nozzle—55,000 lb. per hr.
7-in. four-projection type nozzle—61,680 lb. per hr.

ing on locomotive output as it limits not only the drawbar pull at speed (the horsepower output), but also influences the drawbar pull at all but relatively low speeds. The percentage of boiler output at various piston speeds is illustrated in Fig. 2. This was developed from data appearing in various Pennsylvania testplant bulletins, and is fairly representative of what is and may be expected, under a uniform trend of decreasing evaporation per pound of coal with increasing firing rates in pounds of coal per square foot of grate area per hour. Momentary increases from the relative out-

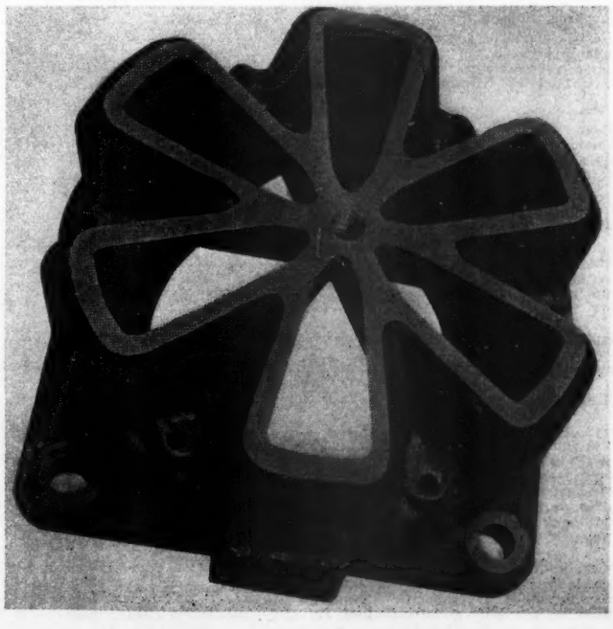


Fig. 5—The annular-ported nozzle

put shown by Fig. 2, can be obtained by forcing combustion through the use of the blower or by "swapping" water for steam, but the curve indicates what can normally be expected.

The effort to increase maximum boiler output through improvement in draft production by selection of draft appliances is well illustrated by the tests made with the Missouri Pacific three-cylinder Mikado type locomotive No. 1699 on the Altoona test plant. Table II gives the data from these tests and Fig. 3 indicates the gain in drawbar pull, which results from an ability to support combustion adequately so as to supply steam to permit working the engine.

Fig. 1 shows clearly that as we increase the peripheral surface of the exhaust steam jet and serrate or "nick" the skin surface, we increase the draft per pound of back pressure, which is the draft efficiency.

This is further substantiated by another quotation from Mr. Goodfellow's remarks, previously referred to: —"The multiple point nozzle will produce the same draft as the present standard four-projection nozzle with approximately 40 per cent less back pressure. This figure is also based on tests made on another of the same class of locomotive" (Pennsylvania I-1-s class). That the character of the nozzle insofar as its shape, distribution of steam jet and peripheral surface determining its entraining power, becomes the essential factor in effecting this draft-efficiency improvement, where the work demands are fixed by the gas resistances and necessity for self cleaning, is reflected by a further remark of Mr. Goodfellow. "The type of front end arrangement using a barrel netting and shield, has no advantages or disadvantages over the present standard type from the standpoint of locomotive performance. If its use is to be justified, it must be on the ground of better and cheaper maintenance and inspection."

It will be noticed from Fig. 1 that as the back pressure increases there is a dropping tendency to all of the draft curves and, if the experiments were carried far enough, it would be found that no increase in draft would result from further increases in back pressure. In fact, it is probable that there would be a decrease, as indicated by the dotted extension to the curves. This is due to some probable application of the well known law of diminishing returns, or to the fact that the velocity of jet flow increases rapidly then tapers off gradually, so that above about 11 or 12 lb. back pressure the increase in velocity per pound of back pressure increase is quite small.

The action of a steam jet on the gases in the smokebox may be likened to that of a jet of water discharged into a vessel of water. The density of hot smokebox gases and exhaust steam are approximately the same, so that the conditions are analogous. The motion produced by the discharging jet on the stationary body will be observed to be one of eddy action, and if the discharging jet is broken or nicked, the eddy action is more pronounced. The eddy action is a function of jet velocity and form characteristic, while the spread of the jet is due to uniform volume following at a decreasing velocity. This in essence is the underlying theory of exhaust jet draft production. Its application is unfortunately not as simple owing to the difficulty of observing and recording action in the smokebox of a locomotive.

Table III—Comparative Performance of Locomotives Equipped Two Types of Nozzles

	Engine 1886—75 per cent max. cut off 7⅝-in. cross-bridge nozzle						
Trip	2	4	6	8	10	12	Av.
Date	3/16	3/29	3/30	4/6	4/8	4/10	....
Average temperature	46.8	48.8	53.5	85.5	66.0	61.2	60.3
Tonnage	3410	3467	3445	3579	3469	3647	3502.8
Cars	50 L 1 Mty	50 L	52 L 1 Mty	52 L	50 L	56 L	51 L 0.3 Mty
Elapsed time	1 hr. 53 min.	1 hr. 27 min.	1 hr. 52 min.	1 hr. 30 min.	1 hr. 35 min.	2 hr. 6 min.	1 hr. 44 min.
Running time	1 hr. 42 min.	1 hr. 27 min.	1 hr. 36 min.	1 hr. 30 min.	1 hr. 35 min.	1 hr. 52 min.	1 hr. 37 min.
Mileage				25.5			
Stops	1	0	1	0	0	0	0.5
Gross ton-miles	86955	88408.5	87847.5	91264.5	88459.5	92798.5	89288.9
Gross ton-miles per train hour elapsed	46150	60900	47050	60840	55800	44190	51500
Gross ton-miles per train hour running	51150	60900	54900	60840	55800	49700	55200
Average back pressure	8.57	10.15	10.50	10.64	8.08	8.45	9.40
Superheat	...	614.6	609.5	599.3	593.1	596.7	602.6
Boiler pressure	197.2	199.3	199.45	193.1	196.5	194.5	196.7
Draft back of diaphragm	4.40	5.23	5.46	5.24	4.33	4.82	4.91
OPERATION TO FILL OUT POINT—43 MILES FROM TERMINAL START							
Water, gallons	10682	9552	10447	10113	9470	11206	10245
Water, lb.	89017	79600	87058	84275	78917	93383	85375
Gross ton-miles	146630	149081	148135	153897	149167	156821	150622
Water, lb. per 1000 gross ton-miles	608	533	587	548	528	595	567

	Engine 1887 12-in. annular-ported nozzle							
Trip	6	8	10	14	2A	3A	7A	Av.
Date	2/26	2/27	3/2	4/20	8/4	8/5	8/10	....
Average temperature	55.5	53.16	44.5	....	77.5	79.25	83.7	....
Tonnage	3419	3401	3416	3582	3558	3634	3646	3522.3
Cars	48 L	49 L	49 L	52 L	51 L 5 Mty	44 L 23 Mty	52 L	49.3 L 4 Mty
Elapsed time	1 hr. 33 min.	1 hr. 40 min.	3 hr. 20 min.	1 hr. 24 min.	2 hr. 1 min.	1 hr. 39 min.	1 hr. 58 min.	1 hr. 56 min.
Running time	1 hr. 25 min.	1 hr. 40 min.	1 hr. 45 min.	1 hr. 24 min.	1 hr. 33 min.	1 hr. 20 min.	1 hr. 33 min.	1 hr. 31 min.
Mileage				25.5				
Stops	1	0	3	0	2	1	2	1.3
Gross ton-miles	87184.5	86725.5	87108	91341	90729	92667	92973	89818.3
Gross ton-miles per train hour elapsed	56200	52000	26100	65200	44977	56162	47266	47198.3
Gross ton-miles per train hour running	61550	52000	49750	65200	58535	69675	59983	59799.1
Average back pressure	6.43	4.60	7.10	6.96	8.67	8.69	6.80	7.04
Superheat	626.3	608.5	625.0	636.0	607.1*	605.8*	595.5*	623.9
Boiler pressure	198.7	198.3	199.4	192.6	197.7	193.3	196.6	196.7
Draft back of diaphragm	4.84	3.96	5.20	5.93	6.15	6.84	4.92	5.41
OPERATION TO FILL OUT POINT—43 MILES FROM TERMINAL START								
Water, gallons	11026	8766	12548	11559	Over		10457	10871.2
Water, lb.	91883	73050	104567	96305	Lexington		87141	90589.2
Gross ton-miles	147017	146243	146888	154026	Branch		156778	150190.4
Water, lb. per 1000 gross ton-miles	625	499	712	625			556	603.3

* Pyrometer found in error and to require recalibrating. Disregard in average.

The article in the September, 1930, issue of the *Railway Mechanical Engineer,* referred to above, gives in detail what may be expected of the annular-ported nozzle in improving draft efficiency. It also presents the principles by which it may be applied to a locomotive. Fig. 4 shows the modification required in the front end of a U.S.R.A. heavy Mikado-type locomotive to use the annular ported nozzle, shown in Fig. 5, in accordance with these principles. In Fig. 6 is shown the horsepower curves developed with the dynamometer car using this nozzle as compared with the result when using a four-projection nozzle and also this output compared with the American Locomotive Company theoretical horsepower curve. These curves indicate that something is accomplished by reducing back pressure and increasing boiler capacity.

In Fig. 7 is shown an analysis of how reduced back pressure with improved draft, accomplishing increased boiler capacity, brings about an increase in locomotive output as exhibited by the curves in Fig. 6. There is, as has been pointed out earlier, an increase in drawbar pull by reducing the braking action of the back pressure

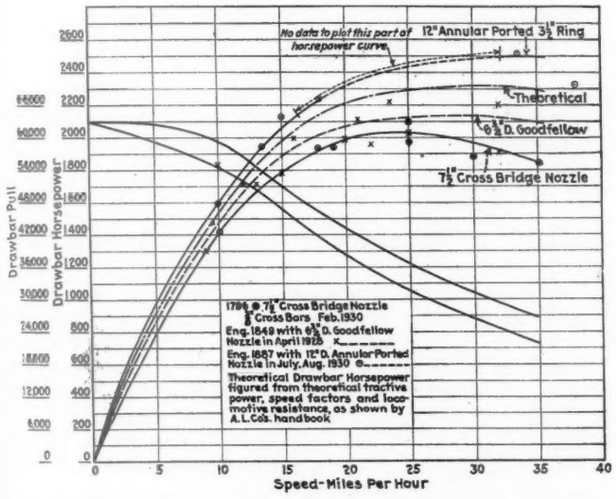

No data to plot this part of horsepower curve
12" Annular Ported 3½" Ring
Theoretical
6½" D. Goodfellow
7½" Cross Bridge Nozzle
1784 ● 7½" Cross Bridge Nozzle 8 Cross Bars Feb. 1930
Eng. 1848 with 6½" D. Goodfellow Nozzle in April 1928 ×
Eng. 1887 with 12" D. Annular Ported Nozzle in July, Aug. 1930 ○
Theoretical Drawbar Horsepower figured from theoretical tractive power, speed factors and locomotive resistance, as shown by A.L.Co's. handbook
Drawbar Pull
Drawbar Horsepower
Speed-Miles Per Hour

Fig. 6—Comparison of horsepower curves of locomotives equipped with various types of nozzles with the theoretical drawbar horsepower curve

on the piston. With judicious selection of an exhaust nozzle to bring about increase in maximum boiler capacity, we have available at all piston speeds, and therefore engine speeds, an increase in potential boiler output. The steam economy of the locomotive is not changed by this reduction in back pressure, therefore we have available at all speeds where the locomotive is not worked in or near the corner the ability to work the locomotive at a longer cut-off using this increased available steam to increase the work output or drawbar pull.

No increase in drawbar pull, or an inappreciable increase, occurs at slow speeds, as the decrease in back pressure is so slight that its effect in increasing mean effective cylinder pressure is almost negligible when working at full cut-off. As the piston speed increases, the back pressure increases and the magnitude of the reduction in back pressure adds to the cylinder output somewhat and appreciably reduces the loss due to the braking action on the pistons. This accomplishes an increase in drawbar pull which has been approximated and assumed to represent a portion of the observed increase as shown by the dotted curve on Fig. 7.

The use of the annular ported nozzle with its improved draft efficiency enables a higher rate of combustion to be supported adequately and accomplishes an increase in maximum output and the output at various speeds. This increase has been arrived at by assumptions from the data developed by standing tests of boiler output with different types of nozzles, and guided by the assumed curve of steam per drawbar horsepower, which appears on Fig. 7, all analyzed in the light of observed dynamometer-car records.

We have previously shown in Fig. 2 that there is a relation between the maximum output of the boiler and the output at various piston speeds. It is reasonable, therefore, to assume that if the maximum output is increased, the output throughout the operating range is increased, as shown in Fig. 7, along the lines of Fig. 2. Since the steam economy of the locomotive is not affected to any extent by the changes in back pressure through nozzle change which permits operation of the locomotive at an increased cut-off, the balance of the increased drawbar pull recorded by the dynamometer car is the result of this permitted increase in working the locomotive made possible by higher boiler output.

Thus while Mr. Goodfellow states that "these tests showed there was practically no difference in the dry coal or dry steam per indicated dynamometer horsepower with the two different nozzles," there is a marked difference in the work output of a locomotive adequately drafted.

This is in accordance with the findings where the annular ported nozzle has been applied. Fuel economy does not necessarily follow from reducing back pressure, unless the locomotive has been previously underdrafted. There is, as a general result of lowered back pressure and adequate draft production, a marked improvement in the locomotive output, reflected in either higher operating speeds with tonnage trains or increase in the tonnage which can be handled.

The annular-ported nozzle, it might be mentioned in passing, is the same as the multiple pointed nozzle mentioned by Mr. Goodfellow except that the port edges of the latter run in a point to a center opening. The

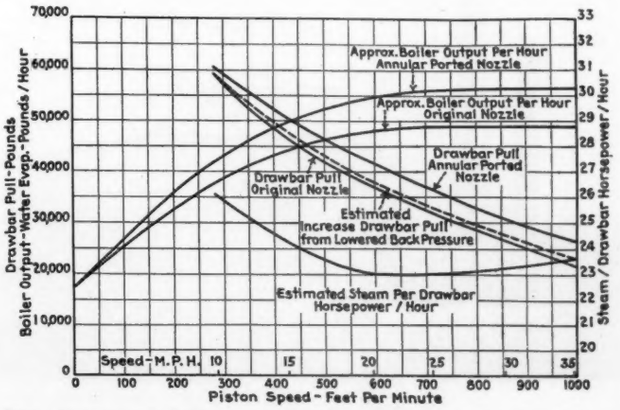

Approx. Boiler Output Per Hour Annular Ported Nozzle
Approx. Boiler Output Per Hour Original Nozzle
Drawbar Pull Annular Ported Nozzle
Drawbar Pull Original Nozzle
Estimated Increase Drawbar Pull from Lowered Back Pressure
Estimated Steam Per Drawbar Horsepower / Hour
Drawbar Pull-Pounds
Boiler Output-Water Evap.-Pounds / Hour
Steam / Drawbar Horsepower / Hour
Speed-M.P.H.
Piston Speed-Feet Per Minute

Fig. 7—An analysis of how reduced back pressure brings about an increase in locomotive output exhibited by the curves in Fig. 6

closed central core of the annular ported nozzle is favored, first because it brings the steam out near the periphery where it does its work, second, because it permits modifying the open area by plate application at the center to adjust the nozzle to several similar classes of power and third, because it readily permits of hydrostatically testing steam pipes, superheater units and the exhaust base with the tip in place.

(Concluded on page 231)

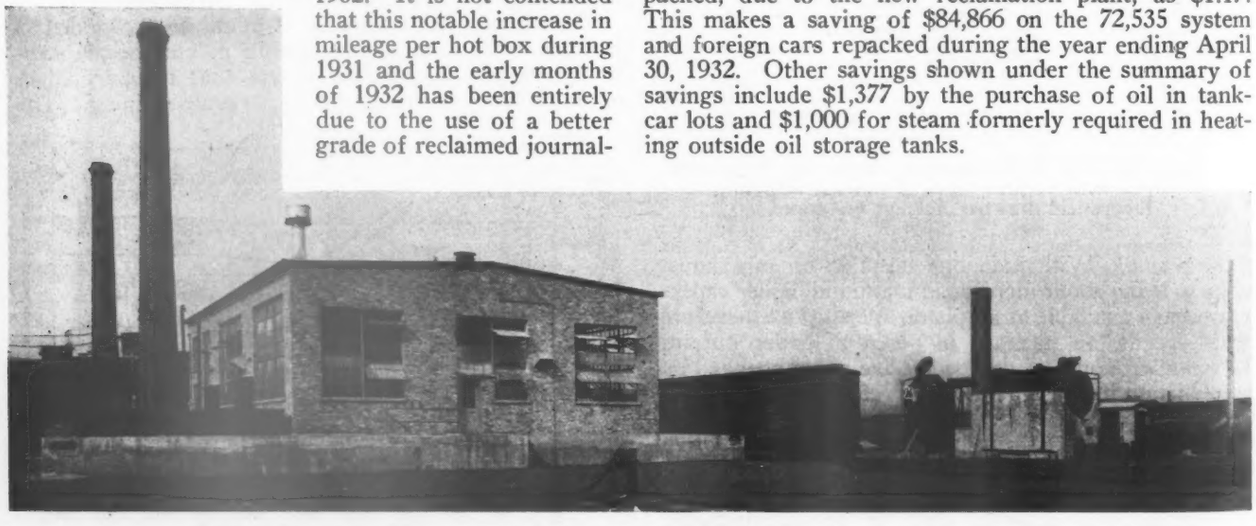
Milwaukee Saves $87,243 A Year On Packing Reclamation

New central plant reclaims 460,000 lb. of waste and waste and oil per month at an average cost of $1.13 per 100 lb. The cost of repacking journal boxes has been reduced by $1.17 per car

IN order to effect savings in the reclamation of oil and waste for journal boxes, and to meet the American Railway Association requirements for packing used in servicing foreign cars, the Chicago, Milwaukee, St. Paul & Pacific installed a modern, centralized reclamation plant at Milwaukee, Wis., slightly over a year ago. This plant, which is operated by car-department forces with the co-operation of the stores department in gathering and redistributing packing to regularly assigned points on the system, includes the necessary fireproof brick building and oil storage facilities, and packing-reclamation machinery and oil-distilling equipment furnished by the Journal Box Servicing Corporation, Indianapolis, Ind. The cost of the entire plant was slightly over $105,000 and, with an output of nearly half a million pounds of reclaimed packing per month during the year ending April 30, 1932, the actual savings were in excess of $87,000, or a return of about 82 per cent on the investment.

Besides the specific savings mentioned, effected largely by reduced labor in handling packing and lessened journal-box packing expense, certain large savings difficult to evaluate have resulted from the improved quality of packing and attendant reduction in hot boxes. It will be noted from Table I that the average mileage between freight-car set-outs on account of hot boxes on the Milwaukee has increased from 135,420 in 1927 to 286,025 in 1931, and 462,802 in the first three months of 1932. It is not contended that this notable increase in mileage per hot box during 1931 and the early months of 1932 has been entirely due to the use of a better grade of reclaimed journal-box packing. An intensive campaign of servicing journal boxes, instituted in 1930, was reflected in the performance of that year, carried through into 1931, and, together with the use of the improved packing, was responsible for the favorable performance secured so far this year. The figures are particularly significant because they indicate a highly satisfactory performance, under adverse winter conditions, of both the packing-reclamation method and the one-season car oil now standard on the Milwaukee. Because of difficulty in ascertaining the cost of hot box set-outs, as well as the difficulty of determining just how many hot boxes have been prevented by the improved packing, no effort has been made to evaluate this saving. That it is large may be readily appreciated from the fact that various authorities have estimated the cost at $20, more or less, for each car set out.

The thoroughness with which all elements of costs and savings of the Milwaukee oil and waste reclamation plant have been balanced is well indicated in the condensed, yet comprehensive, analysis presented in Table II. With all items of labor, material, stores expense, transportation and overhead expense carefully accounted for, over five and a half million pounds of packing were reclaimed at a cost of $1.13 per 100 lb. of packing turned out. The cost per 100 lb. at the point of use is shown as $1.30 and the saving per car repacked, due to the new reclamation plant, as $1.17. This makes a saving of $84,866 on the 72,535 system and foreign cars repacked during the year ending April 30, 1932. Other savings shown under the summary of savings include $1,377 by the purchase of oil in tank-car lots and $1,000 for steam formerly required in heating outside oil storage tanks.



System oil and waste reclamation plant of the C. M. St. P. & P. at Milwaukee, Wis.

The record of oil and waste reclamation by months is given in Table III, which shows the uniform production maintained throughout the year. The packing turned out per day averages 22,735 lb.; oil reclamation loss at the still averages 10.2 per cent; and total oil and waste reclamation loss averages 17.0 per cent. The labor cost per hundred pounds exhibited no marked trend but there was a noticeable decline in the amount and cost of new material purchased, including oil and waste, so that the total reclamation cost per hundred pounds decreased substantially to a minimum of 96

cents per hundred in April, and an average of $1.13 for the year.

The way in which oil and journal-box packing, reclaimed at the Milwaukee plant, checks up with and more than meets the A. R. A. requirements is shown in Tables IV and V. It will be noted that, in addition, other values have been included in the Milwaukee

Table I—Freight Cars Set Out on Account of Hot Boxes on the Milwaukee System

Year	No. of freight cars set out account of hot boxes	Average mileage between freight-car hot boxes set out
1927	6,718	135,420
1928	6,909	140,067
1929	7,622	128,140
1930	5,241	162,030
1931	2,490	286,025
1932 (3 mos)	311	462,802

specifications for both waste and oil because some of them are believed to be of great significance in indicating the value of the material. The specifications for the one-season car oil adopted by the Milwaukee, together with the better grade of waste for freight cars, are shown in Table VI.

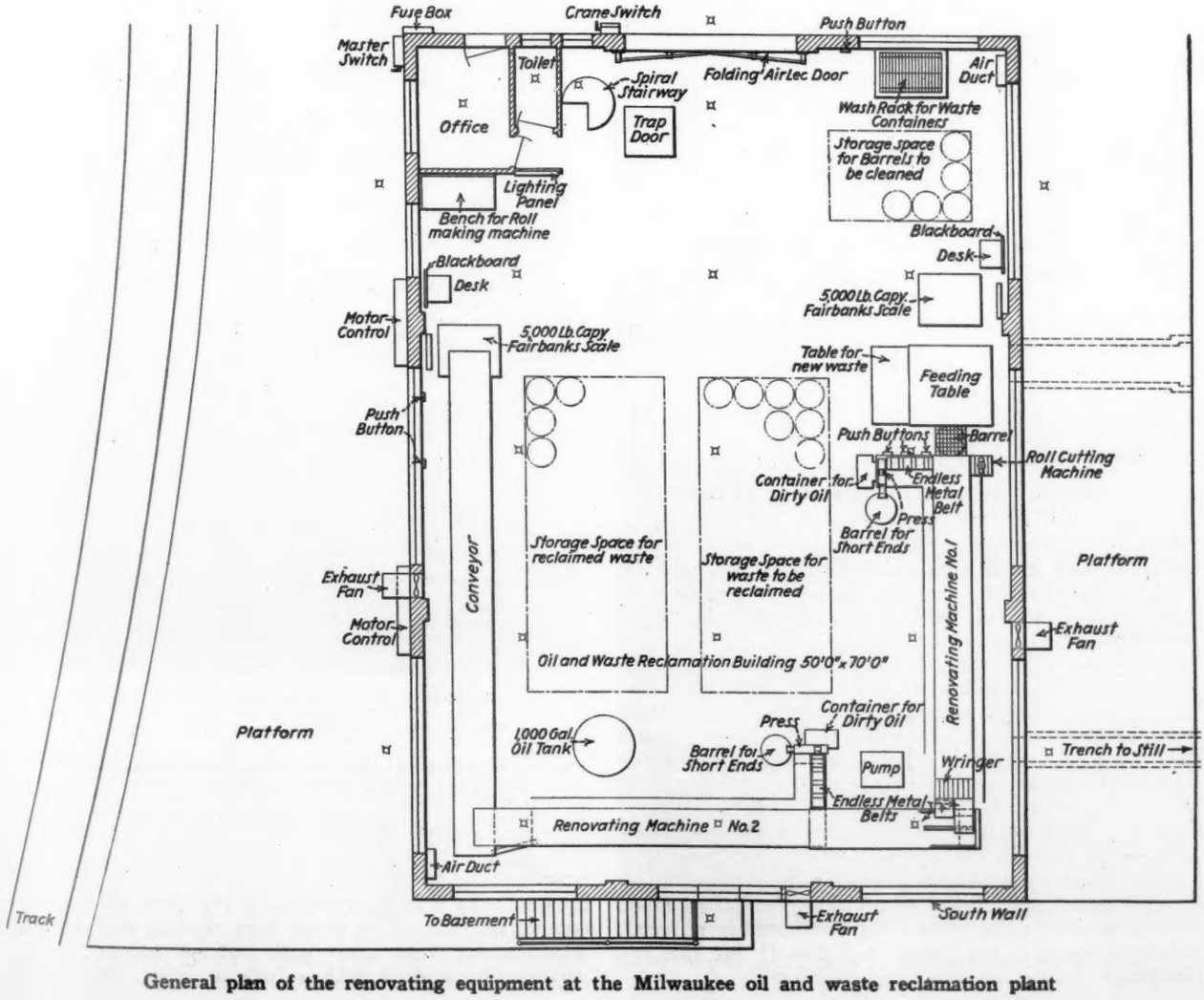
Journal Repacking Work Consolidated—Distribution of Packing

One of the major economies, made possible largely by the installation of the new oil and waste reclamation plant, is the consolidation of repacking work. The C. M. St. P. & P. operates in 15 states with 11,345 miles of track and approximately 74,000 system freight cars, including work equipment.

The former practice provided for repacking boxes at 63 points on the railroad, of which 28 points had renovating facilities. This number has been reduced to nine regularly assigned repacking points, with one central plant at Milwaukee, which meets the packing requirements of the entire system with the exception of the territory adjacent to Tacoma, Wash. In cases of emergency, individual boxes are repacked at all operating repair points, as in the past.

An economical and efficient method of shipping the packing has been worked out in conjunction with the stores department, which provides for weekly shipments in carload lots of an agreed amount of packing on designated days to the larger points and either weekly or monthly scheduled shipments to the smaller points, together with the consignment of other material. The weekly shipments vary from 300 lb. to Nahant, Iowa, to 22,500 lb. to Minneapolis, Minn.; the monthly shipments, from 50 lb. to Watertown, Wis.; to 1,800 lb. to Wausau. The average train haul on these shipments of prepared packing i sestimated to be 375 miles from Milwaukee. The dates of packing shipments coincide with the stores departments' previously assigned "Sailing dates" of other material from the main distributing point at Milwaukee.

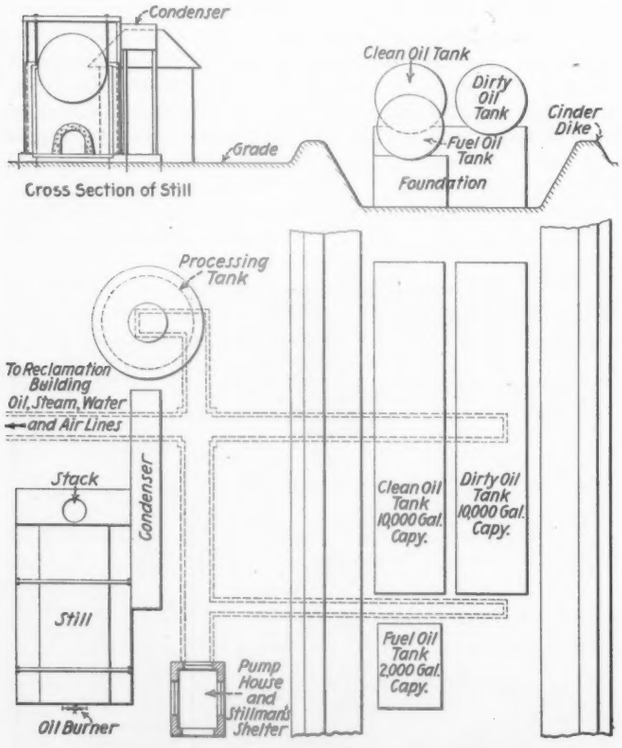
The container adopted as standard for the hauling



General plan of the renovating equipment at the Milwaukee oil and waste reclamation plant

of the packing is a straight side drum with a removable head. The head is attached to the drum by a heavy crescent-shaped steel loop, tightened by a single bolt; a cork gasket placed between the head and the drum provides an air-tight joint to keep out water and other foreign material. Lift trucks, or hand trucks, are used at the designated repacking points, to convey the drums of packing from storage to the point of use on repair tracks, the drums containing packing sufficient to repack four cars completely. An empty container is also made available on the repair track to receive the old packing. The lift, or hand truck, making the delivery of the reclaimed packing, takes with it on its return trip, the drums of old packing to the point of storage.

As the reclaimed packing is placed in the drum containers at the reclamation plant immediately after coming out of the hot-oil bath, the oil finds its way to the bottom of the container by the time the shipment arrives at the repair track. In order to eliminate the necessity for having soaking vats, the drums are placed on their sides on inclined racks at repair points, and are given a half-roll the evening before being used, to allow the oil to run back and mix with the dryer packing.



Arrangement of the still and outdoor oil tanks

In concentrating the repairing work at nine major points where the air-brake, draft-gear and other necessary work is performed at the same time, forces have been specialized and a considerable saving effected over the former practice. The labor savings in "dope" houses alone, because of being provided with prepared packing, amounts to approximately $25,000 a year. This has been made possible by the reduction from 32½ to 14 full-time positions working less than one-half the number of hours per month. By specialization of forces and closer supervision, the actual labor cost of repacking cars has been substantially reduced, although credit is not taken in Table II for this reduction.

The former method of reclaiming journal packing on the Milwaukee was similar to that employed by many other roads. Crude pickers and tumbling machines of various types were used to free the waste of dirt, babbitt, short ends, etc., and at some points home-made presses were used to squeeze out the dirty oil from incoming packing. The waste thus cleaned was dumped into soaking vats filled with hot oil, where it was periodically worked with a fork to bring about thor-

Table II—Detailed Analysis of the Cost of Operating the Plant and the Savings

Cost of operating waste-reclamation plant, May 1, 1931, to April 30, 1932:		
Labor	$12,822	
Material, supplies and power-plant expense	26,143	
Store expense:		
Old packing shipped in to renovate 5,774,731 lb. at 1 cent per lb. value	$57,747	
Store expense on old packing at 12 per cent	6,930	
Transportation of old packing shipped to Milwaukee, 5,774,731 lb., average haul 375 miles	1,732	
Transportation of new material and supplies:		
912,488 lb. oil, Kansas City, Mo., to Milwaukee, 513 miles	374	
91,967 lb. waste, Chicago to Milwaukee, 85 miles	6	
Total		$48,007
Overhead expense:		
Cost of building, oil-storage tanks, etc.	$50,998	
Machinery	54,815	
Total	$105,813	
Interest, 6 per cent of $105,813	6,349	
Depreciation: 2 per cent of $50,998	1,020	
5 per cent of $54,815	2,741	
Maintenance: 1 per cent of $50,998	510	
5 per cent of $54,815	2,741	
Taxes and insurance, 1 per cent of $105,813	1,058	14,419
Total expense of operating renovating plant		$62,426
Renovated packing turned out		5,518,137 lb.
Cost per 100 lb. of packing turned out		$1.13
Savings in cost of repacking cars:		
Total expense of operating renovating plant		$62,426
Store expense for handling to point of use at 12 per cent		7,491
Transportation of renovated packing to point of use, 5,518,137 lb., average haul 375 miles		1,655
Total cost of 5,518,137 lb.		$71,572
Cost per 100 lb. of renovated packing at point of use		$1.30
Cost of reclaimed packing per car repacked at 72 lb. per car		.94
Cost to repack a car under present method of reclaiming packing:		
Labor, repacking car	$.84	
Cost of reclaimed packing, 72 lb. per car	.94	
Total		$1.78
Cost to repack a car under former method of reclaiming packing:		
Labor, repacking car	$.84	
Cost of reclaimed packing and new oil and packing:		
Labor reclaiming packing	.93	
Steam and electricity	.04	
New oil and waste:		
332,563 lb. fibre packing at 10 cents per lb.	$33,256	
2,679 lb. spring packing at 18 cents per lb.	482	
223,878 gal. car oil at 13 cents per gal.	29,104	
Store expense, 12 per cent	7,541	
Transportation: 335,242 lb. packing and 223,878 gal. oil, or 1,679,085 lb. 1,007.16 tons average haul 568 miles	915	
Total	$71,298	
Total cars repacked	62,565	
Cost per car	1.14	
Total		$2.95
Savings per car repacked due to new reclamation plant		$1.17
Annual savings:		
72,535 cars repacked during year ended April 30, 1932 Annual savings on repacked cars 72,535 times $1.17		$84,866
Savings in oils purchased in tank-car lots instead of drums:		
13,426 gal. locomotive journal oil at 1 cent per gal.	$134	
21,756 gal. kerosene at 2½ cents per gal.	544	
139,824 gal. locomotive valve oil at ½ cent per gal.	699	
Total		$1,377
Savings of steam used to heat oil in former outside storage tanks (Oil now stored in tanks in basement of reclamation plant)		$1,000
Total annual savings, year ended April 30, 1932		$87,243

ough saturation with the oil, as well as to work out as much as possible of the remaining dirt. After this the waste was placed on drain racks to remove the excess oil. No attempt was made to clean or distill the old oil with the exception of the use of settling tanks at a few points. As a result, much of the dirty oil found its way into the resaturated packing to which some new oil and new waste had been added. This process was slow and laborious and did not produce a satisfactory quality of reclaimed packing.

Through the efforts of the Mechanical Division Committee on Lubrication, interest was focused on better methods of reclamation which would increase the general efficiency of journal lubrication. The outcome of this renewed interest has been the development of several satisfactory mechanical methods that permit the reclamation of large quantities of packing quickly and economically with a minimum of manual labor. These methods include agitation in a rotating cylinder containing hot oil; forcing clean, hot oil under pressure through the dirty waste; a series of immersions in hot oil followed by extraction in a centrifuge; and alkali washing. Not only have methods been devised for cleaning the waste more thoroughly, but better methods of purifying the oil have been provided. Centrifuging, chemical treatment and distillation are all used, either alone or in combination, to produce oil that complies with the A.R.A. requirements. The system adopted by the Milwaukee is the distillation method for the reclamation of oil and an automatic mechanical method for washing the dirty packing in hot oil.

Table III—Record of Oil and Waste Reclamation—Plant Output by Months

Month	Lb. of dirty packing run through plant	Lb. of packing turned out		Per cent reclamation loss		Reclamation cost—cents per 100 lb.			
		Total	Average per day	Oil at still	Total oil and waste	Labor	Material, stores exp., trans. and p. p. exp.	Total	Total cost including carrying charge
May	458,429	463,500	18,540	8.5	17.8	19.4	62.6	82.0	$1.08
June	490,815	475,534	18,290	9.9	16.5	22.8	77.9	100.7	1.26
July	580,239	589,800	24,575	10.1	15.4	21.9	84.8	106.7	1.27
August	471,244	462,300	22,729	10.1	18.5	26.2	78.6	104.8	1.31
September	475,897	462,210	21,010	10.3	22.3	24.2	73.6	97.8	1.24
October	517,988	491,550	22,343	10.7	17.5	23.6	66.4	90.0	1.15
November	468,483	457,543	24,081	10.3	17.2	23.7	71.3	95.0	1.21
December	471,152	457,400	23,456	10.4	13.7	25.2	57.5	82.7	1.09
January, 1932	435,510	391,750	24,484	10.2	17.6	25.1	50.5	75.6	1.06
February	445,897	401,400	25,088	10.5	17.8	22.4	39.8	62.2	.92
March	481,032	431,150	22,692	10.2	16.0	22.5	44.0	66.5	.94
April	478,045	434,000	25,529	10.7	13.7	22.3	45.5	67.8	.96
Total	5,774,731	5,518,137							
Average	481,228	459,845	22,735	10.2	17.0	23.3	62.8	85.9	$1.13

Gould high-pressure hot-water pump for washing out containers

Plant Location and General Method of Operation

The location of the new plant is on a site formerly occupied by a battery of various sizes of oil tanks located in the open for the storage of different kinds of oil. This site was selected as ideal for the handling of materials, since the tracks were so arranged as to facilitate the handling of inbound and outbound material and at the same time was close enough to the stores department to permit making up car loads of reclaimed packing and other material to outside points with the least amount of lost motion.

The waste reclamation building is a 50-ft. by 70-ft. structure, with a large proportion of window area to give good lighting conditions.

On the main floor of the plant, the large center space is reserved for the storage of containers for waste to be reclaimed and for renovated waste. The waste-

Spray nozzle and rack for cleaning container interiors with high-pressure hot-water jets

reworking machinery is located around the east, south and west walls of the building, incoming waste being first weighed and then passed to the receiving table where it is pulled apart by hand on a coarse grating, which permits fine dirt and short ends to drop through, all large pieces of foreign matter being picked out. The packing then is fed evenly to the conveyor of renovating machine No. 1. A roll cutter is provided, consisting of a rotating circular knife to cut back rolls of packing before being fed to the machine.

For handling the container in the reclamation plant, a specially-constructed locking clamp has been developed. This rigging is attached to the hook on a one-ton traveling crane, so arranged that the container can be lifted and carried to the feeding table, where, by means of a trigger, the lock is released and the contents dumped. The container is then moved to the wash rack where the inside is thoroughly cleaned by means of high-pressure hot-water jets.

Table IV—Analysis of Oil Reclaimed by the New Method on the Milwaukee, Compared with the A.R.A. Requirements

	A. R. A. requirements for renovated oil	Oil renovated by the new method on the Milwaukee
Flash point	250 deg. F.	280 deg. F. avg.
Vis. at 130 deg. F. min.	70 sec.	80 sec. avg.
Vis. at 210 deg. F. min.	40 sec.	43 sec. avg.
Vis. at 210 deg. F. max.	70 sec.	
Precipitation cc. max.	0.5	0.15
Pour point F. deg. max.	45	15
Water, max.	1.0 per cent	nil
Ash	Not specified	0.20
Tarry matter	Not specified	0.15 per cent

In the tank of renovating machine No. 1, the packing is immersed in oil at a temperature of 220 to 240 deg. F., being carried along on top of a series of grates submerged about 6 in. below the surface until it has become heated throughout to the temperature of the bath. All moisture is evaporated from the oil during this operation. The packing is next subjected to vigorous agitation by a series of forks which work the waste back and forth and at the same time open it up and pull it apart thoroughly. The forks draw the waste along on the submerged grate which extends the entire length of the tank so that when it reaches the end, most of the dirt and short ends have been loosened and fallen through the grate. A scraper conveyor works along the bottom of the tank continuously, removing all solids and short ends that fall through the grate and discharging them into a receptacle located at the front end of the tank, from which they are conveyed to a machine which presses out the oil and forms them into briquets, used in firing up locomotives and furnaces. At the exit end of the first tank, the reclaimed waste is dragged up an incline by a series of picks and delivered to an endless metal belt. The waste is carried to this belt between a pair of specially constructed rolls which squeeze the oil out under a pressure of 2,500 lb. per sq. in.

The reworked waste at this stage contains about 35 per cent of oil and is quite clean. The next step in the process consists of resaturating it with oil. This is done in the tank of renovating machine No. 2, which is filled with new or reclaimed car oil. The temperature is maintained at about 220 to 240 deg. F. Not only is the waste resaturated with oil here, but also any short ends remaining are removed. As in the first tank the waste is dragged out by a set of picks, and passes up an inclined section of grating to be delivered to an endless belt for the final step in the process.

The conveyor for the last stage carries the waste through a long box-like tunnel and series of rollers, where the surplus oil drains away. The speed of the conveyor can be adjusted so that just the right quantity of oil remains in the waste when it drops into the shipping container at the discharge end. Provision is made for weighting the packing at both ends of the machine so that a record can be kept of the quantity handled. The capacity of the machine is about 2,000 lb. of finished packing per hour. It requires 45 min. for the waste to pass from the intake to the discharge end.

Purification of the Oil

Since a considerable percentage of the oil is squeezed from the waste by the rolls at the end of the first machine, there is necessarily an accumulation of dirty oil. This is dumped out at intervals into a storage tank. When sufficient has been accumulated for a batch, it is purified by a fire and steam distillation process in a still similar to that used in the refining of crude oil. The still itself is simply a cylindrical tank of 5,000 gal. capacity placed horizontally in a firebrick setting. It is heated by an oil burner and is provided with perforated pipes near the bottom for the admission of steam. The dirty oil is pumped into the still, the fire started and when the proper temperature is reached steam is admitted. The distillation of the oil is accelerated by the use of steam, and the vaporized oil and steam pass through a condenser into a collecting tank. The condensed steam separates from the hot oil and settles to a conical bottom where it is drawn off at frequent intervals. The foreign matter, including sand, metallic particles, tarry products, fibres and hot-box cooling compounds are left behind in the still with a small amount of coke which is formed during distillation. Some heavy oil is also left in the still, being too heavy to be carried over. A thin layer of coke, about 40 per cent of which is sand, metal, etc., forms in the still and has to be chipped out after the still has cooled off. It is a waste product of no value, being too low in combustible matter for use as fuel.

Straight-side drums being filled with renovated packing as it leaves the machine

The oil drawn off from the bottom of the still immediately after each distilling process would become plastic solid if permitted to cool. The oil is gathered in 50-gal. containers where it is mixed in the proportion of one part of distillate and four parts of oil. This keeps it in a liquid state. The mixture is known as road oil, and is used for protecting rail ends, anchor bars, track fittings and signal cross-pipes. Tests indicate that this material dries quickly and hard without leaving any oily surface. Additional experiments

are being made with this material as a metal preservative.

The plant is operated on three shifts, with one foreman supervisor, five car-men helpers on the first shift from 7 a.m. to 3:30 p.m.; four men on the second shift from 3:30 p.m. to 11:30 p.m., and two men helpers on the third shift from 11:30 p.m. to 7:30 a.m. On the first shift, one man operates the still which requires about 5½ hours to fill and 13 to 14 hours to run over. On the third shift, the machinery is oiled, the plant cleaned and the oil brought to the proper temperature, ready for line operation during the first two

The receiving end of the waste-reclamation machine—The machine for forming short-end briquets under heavy pressure is in the foreground

shifts. The first operator on each shift dumps and washes barrels; the second feeds the packing into the machine; the third takes renovated packing, fills and covers barrels and makes renovated packing ready for shipment; the fourth cuts the rolls, watches the oil level in the machine, etc.; the fifth operator takes care

Table V—How Reclaimed Packing on the Milwaukee Checks Up with the A.R.A. Requirements

	A. R. A. requirements for prepared packing	Prepared packing by the new method on the Milwaukee
Water, max.	7 per cent	1.3 per cent
Dirt and foreign matter, max.	7 per cent	.4 per cent
Strands shorter than 3 in., max.	10 per cent	0.9 per cent
Oil	Not specified	75.4 per cent
Waste	Not specified	22.9 per cent
Ash	Not specified	5.6 per cent

of the still and the renovating oil. The loading and unloading of cars is done by the stores department.

Oil Storage Tanks and Pumping Equipment

Oil storage facilities consist of a battery of eleven 10,000-gal. rectangular tanks located in the basement of the packing reclamation building. The 10,000-gal. tanks are of all-welded construction, using ¼-in. plate for the sides, ends and bottom, while $\frac{3}{16}$-in. plate was used for the top. All seams are continuously welded inside and outside, and the top and bottom sheets are flanged over the side and end plates. Each tank has a manhole 16 in. in diameter in the end and a 2-in. vent connection brought to the outside of the building.

The pumps for oil delivery from the basement to the old oil house are of the geared type and have a rated capacity of 90 gal. per min. at 35 lb. pressure. These pumps are driven by explosion and vapor-proof motors with remote-control starting buttons in the old oil house.

As the bulk storage tanks and pumps are located in the basement of the reclamation building and the barrel-filling equipment and supply piping thereto are located in the adjacent oil house, the remote-control motor starting switches for the pump were placed in the oil house within easy access of the men engaged in filling barrels.

The tanks are connected with four vapor-proof electric pumps that either pump the oil from tank cars into the storage tanks or from storage tanks into the ship-

Table VI—Milwaukee Specifications for New One-Season Car Oil and Waste

OIL	
Flash point, minimum	300 deg. F.
Viscosity at 130 deg.	145 sec., max.
Viscosity at 210 deg.	40 sec., max.
Moisture—maximum	0.1 per cent
Tarry matter—maximum	0.05 per cent
Insoluble impurities	0.1 per cent
Pour point—maximum	0
WASTE	
Wool threads	35 per cent
Soft cotton threads—Cop and spooler	45 per cent
Soft cotton slasher	20 per cent

ping containers. The piping system is also so arranged that gravity flow can be used.

Separate feed lines are installed to supply the fuel tank to operate the still; another leads outside of the platform as a supply line for yard cranes, and another leads to the first floor for new car oil when required for renovated packing. All the piping that runs outside of the building is placed in concrete trenches, the chief object being to provide for ready inspection and protect them against vibration caused by train movement.

Steam Piping and Heating

Steam is brought to the building from the mains at 160-lb. pressure and is reduced in steps through reducing valves, from 160 lb. to 100 lb. and from 100 lb. to 15 lb. pressure. The 100 lb. pressure is used for the still process work and for heating the storage tanks, while the 15-lb. pressure is used for the heating system.

Wall radiation and a 2,000 cu. ft. per min. unit heater are used to heat the basement. The unit heater is used during working hours to provide air changes specified by the state. The first floor is heated by means of a 5,000 cu. ft. per min. unit heater, which heats the room to 70 deg. F. in winter and provides five air changes per hour as required by state law for gaseous areas. The office and toilet are heated by wall radiation. The heating system is of the vacuum type and includes an electrically-driven vacuum pump which discharges to the return mains at 40 lb. pressure.

Simple and novel storage-tank heaters were developed to heat the heavier oils to reduce their viscosity in pumping. On earlier installations, trouble had been experienced with the conventional pipe coils due to leaking at the joints which allowed water to mix with the oil. The type developed and used employs a piece of superheater tubing with spun heads, into which is inserted a piece of ¾-in. pipe, the open end of which extends through to within 6 in. of the end of the tube. A drain outlet boss was welded into the forward end of the cylinder, which is at the lowest point and extends outside the end of the tank, to which is connected a medium-pressure radiator trap. Steam, at 60 to 100 lb. pressure, is used to heat the tube, the condensation being taken off by the trap and discharged into the return line. These heaters have proved very effective, due to their large radiating surface, and no trouble has been experienced through steam leakages.

Why Can't You Buy Oil on Specifications?

*By K. A. Newman**

THE present tendency toward purchasing all materials on specifications is undoubtedly a step toward wiser and more scientific purchasing. However, specifications, like any other movement, are not a cure-all and should be applied with intelligence.

A set of specifications can never take the place of business integrity and unfortunately, specifications have frequently served as a clock for the unscrupulous supplier. This is frequently true in the purchase of lubricating oils. No set of specifications, however inclusive, has ever been able to guarantee the quality of lubricating oils. This is due to the fact that that intangible quality "oiliness" or "lubricating ability" cannot be covered in a set of specifications. Of course, if the supplier could specify the exact nature of crude from which the oil was to be refined and all of the details of refining, as well as the final specifications of the oil he might be more nearly sure of the quality of the oil bought on specifications. But then how could he tell whether all of his specifications regarding the source and manufacturing process had been adhered to?

Hence if a set of specifications cannot guarantee the quality of the product purchased it seems wiser to buy on the integrity of the supplier for supplying the best product for a given purpose at an economical price.

Oil specifications refer to the physical specifications of an oil and not to its lubricating ability. A set of specifications is usually created by analyzing some oil which has been successful on the job. The physical properties of oil usually referred to are: Viscosity, flash point, fire point, and cold or pour test. While these factors look fine on a laboratory report, they do not indicate the lubricating value of oil, nor do they insure the satisfactory performance of the oil.

Viscosity

The viscosity of an oil merely measures its resistance to flow through a certain size orifice. The temperature of the oil has a great influence on its viscosity. Therefore, for purpose of comparison viscosity readings are usually taken at a temperature of 100 deg. F. (38 deg. C.). However, the size of the orifice in the bearing being lubricated and the temperature of the bearing seldom agree with the size of orifice and the temperature at which the viscosity was taken. Two oils having the same viscosity in a laboratory test taken at 100 deg. F. may not have anywhere near identical viscosities at the somewhat higher temperatures under which they may have to operate.

Oils of the same viscosity can be made from either asphalt-base crude or Pennsylvania crude, and yet their lubricating values will differ greatly. Therefore, viscosity readings do not mean much except to the experienced lubrication engineer, and to the oil refiner as a check on the uniformity of his product.

Viscosity is useful as an indicator of internal friction, as a thick oil will have greater internal friction than a thin oil. But here again it means nothing unless taken at the temperature at which the oil is to be used. The viscosity curves of different oils will be found to vary greatly. By that we mean that two oils of the same viscosity at 100 deg. F. may not be anywhere near the same at 150 deg. F. or 175 deg. F. The viscosity curve of an oil sometimes remains fairly flat through a temperature rise of 10 deg. or even 25 deg., and then may fall away very rapidly.

Flash and Fire Tests

The flash test of an oil indicates the temperature to which an oil must be heated at a specified rate so as to free enough vapor to flash, or momentarily ignite, when it is subjected to an open flame. In testing oil for its flash test, the oil is gradually heated and at each few degrees rise of temperature a small flame is applied to the surface of the oil for a few seconds. As soon as the oil flashes, this temperature is taken as its flash point.

The fire test of an oil is the temperature, usually 25 to 75 deg. F. above the flash point, at which the oil gives off sufficient vapor to burn steadily if subjected to an open flame.

Flash and fire tests are usually given a great deal of prominence when oil is to be subjected to service at high temperatures. Flash and fire tests, however, are taken at atmospheric pressure and an open flame is brought into contact with the oil. In air-compressor lubrication, for example, it is customary to specify an oil of high flash point, but the oil functions under high pressure, which automatically raises its flash point, and it never comes into contact with an open flame. In this and many other applications the flash and fire tests made in the laboratory usually mean little so far as the suitability of the oil for a given service is concerned.

Cold Test

The cold test of an oil, which is also given considerable prominence, is only useful where the oil is liable to be subjected to low temperatures in operation, which would tend to congeal an oil if it did not have a sufficiently low cold test. The cold test is sometimes called the pour test, and simply indicates the lowest temperature at which the oil will flow. Specifications for refrigerating-machine oils sometimes call for a Pennsylvania crude with a cold test of as low as minus 5 deg. F. The lowest cold test obtainable with pure Pennsylvania crude is about minus 25 deg. F. The only way to lower this is by dewaxing which makes a very expensive oil. So the man who says he is selling a regular priced oil made from pure Pennsylvania crude with a cold test much below minus 25 deg. F. does not know much about oils.

Horse Trading and Oil Buying

Years ago horse-trading used to be quite a common business. The physical specifications of a horse were its age and its weight. You could tell its age by looking at its teeth and get its weight by putting it on the scales. But the wise horse trader never bought a horse purely on "specifications." He would insist upon a "work test," because he was more interested in what the horse would do than its physical specifications. If he were buying a trotting horse, he wanted to find out how fast the horse would go and how long he would keep it up. If he were buying a work horse, he would want to know how much the horse would pull, how fast he could pull it and how long he would keep on working.

Buying oil today is almost as hazardous as horse trading in the old days. Mistakes are mighty expensive and are very easily made. A man who is gullible enough to buy oil on physical specifications is almost sure to have a lot of "lame" oil put over on him.

J. R. Battle, in his handbook, "Industrial Oil En-

* Mr. Newman is a member of the research staff of E. F. Houghton & Co., Philadelphia, Pa.

gineering," says: "It is unfortunate that lubricating oils lend themselves so readily to a number of scientific tests, because due to this fact, these tests have become the common property, to a very considerable extent, of operating engineers, oil salesmen, purchasing agents and others who are not equipped with sufficient knowledge of the refinement of oil to appreciate what the tests really signify."

You buy an oil to lubricate under certain definite conditions rather than to meet certain physical specifications. There is no job of lubrication which has one oil of certain prescribed tests as its only solution. Those who try to sell oil on specifications rather than on performance are usually trying to throw a smoke-screen to cover up the poor quality of their oil.

Relation of Back Pressure to Locomotive Performance

(Continued from page 223)

A few instances may be of interest showing improved locomotive operation effected by reduced back pressure and bettered boiler capacity through the use of the annular ported exhaust nozzle. An interesting comparison is afforded by the following results from dynamometer tests with two Mikado type locomotives of the same class, Nos. 3188 and 3158, the former of which was equipped with a four-projection nozzle, 6-9/32 in. in diameter with an area of 30.63 sq. in., while the latter was equipped with a 14-in. outside diameter annular-ported nozzle with an open area of 41.28 sq. in. These engines had 23-in. by 32-in. cylinders, 63-in. drivers, 200 lb. boiler pressure and a tractive force of 67,700 lb.

	West bound		East bound	
	3158	3188	3158	3188
Avg. speed, m.p.h.	21.0	18.39	18.2	14.9
Avg. boiler pressure, lb.	193.2	195.0	195.7	195.0
Avg. exh. pres., lb.	6.7	8.6	6.6	8.1
Avg. front end draft, in. of water	9.8	10.2	9.5	10.7
Avg. actual tons hauled	2261	2377	5918	5891

East bound operation, loaded movement; westbound primarily empty-car movement.

The comparative performance of a U. S. R. A. 2-8-2 B locomotive with the annular-ported nozzle is shown by Table III with one of identical characteristics, except that it is equipped with 75 per cent restricted maximum cut-off rather than a full gear cut-off valve, together with a 7⅝-in. cross-bridge nozzle. This if anything favors the engine with the cross-bridge nozzle.

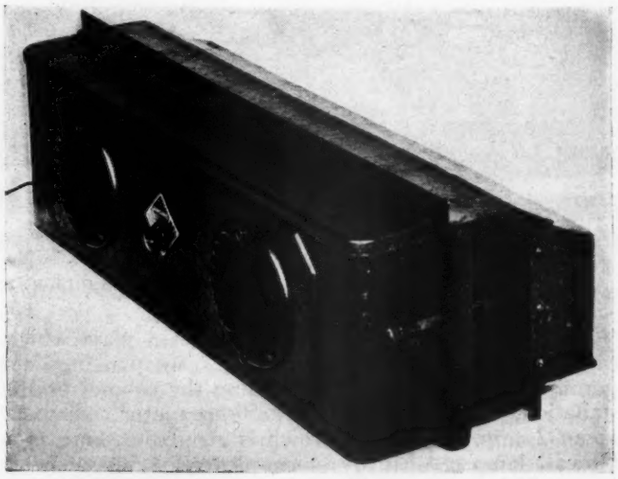
Operating characteristics in the territory where the locomotive was operated were such that it was difficult without the aid of a dynamometer car to develop the value of the annular-ported nozzle. Consequently in the absence of a car, the comparison shown in Table III was resorted to. The operation out of the terminal in the direction of loaded movement offers a good field for picturing comparative locomotive performance. There is a steady climb for about 26 miles out of the river valley in which the terminal is located to the main line at the top of the water shed. All locomotives handling tonnage trains are worked to capacity and any improvement effected in locomotive steaming or cylinder performance will be reflected in the observed results.

It will be noted that the locomotive equipped with an annular-ported nozzle handled a greater average tonnage than the locomotive equipped with a cross-bridge nozzle in a shorter running time, despite an average of 1.3 stops en route as compared with an average of 0.5 stops with the latter locomotive. This resulted in the delivery of a greater number of gross ton-miles per train hour of running time, with an average back pressure decrease of 25.1 per cent, and yet with an increase in draft back of the diaphragm. The only point of superiority in the locomotive equipped with a cross-bridge nozzle is in the average water consumption per 1,000 gross ton-miles and considering the high detention on Test 10 with the annular ported nozzle, the showing is not far from equal, when the higher average speed, and therefore work output, is considered. Disregarding Test 10, the average for locomotive 1887 is 577 lb. per 1000 gross ton-miles as compared with 567 lb. for locomotive 1886. Subsequent dynamometer-car tests have developed the comparative data as to horsepower output and tractive force illustrated and analyzed in Figs. 6 and 7.

There is unquestionably a field for development of exhaust nozzles more in keeping with the demands of modern high powered locomotives. Utilization of the exhaust steam offers a simple device for draft production and one well suited to that task from its characteristic of matching the draft to the combustion demands for the steam requirements. However, as has been pointed out, it acts as a brake, restricting the possibilities of locomotive output. Reduction in back pressure will increase output, and the judicious selection of exhaust nozzles will accomplish not only the relieving of this brake resistance, but will further increase output through increased potential boiler capacity.

Window Ventilators To Provide Clean Air

A TYPE of window ventilator which has been successfully used for ventilating and filtering the air for homes and offices has been adapted to perform similar functions for passenger cars. This device for filtering out the dust, dirt and cinders from the air passing through the ventilator has been developed by the American Air Filter Company, First and Central avenues, Louisville, Ky. Applications of the ventilator, known as the Airgard, were first made to a Louisville & Nashville dining car in August, 1931, and tested over a period of six months during a wide variety of weather conditions.



Airgard unit as installed on a car—The push lever on the right operates the air-stop or damper

An Airgard unit is installed at each table in a dining car—The center knob controls the speed of the motor and fans

These tests are reported to have demonstrated that the device not only eliminated dust, dirt and cinders, but also improved the condition of the air within the car.

The device consists of a small, compact cabinet, 24½ in. by 7¾ in. by 6¾ in., in which is a motor, two rotary blower fans and air ducts, installed under the sash in each car window opening to provide a pure air supply at each table. Outdoor air is cleaned by passing through a mat filter and is admitted to the car through two rotary louvres on the front or inside panel, which may be adjusted by the persons at the table to suit their own sense of personal comfort.

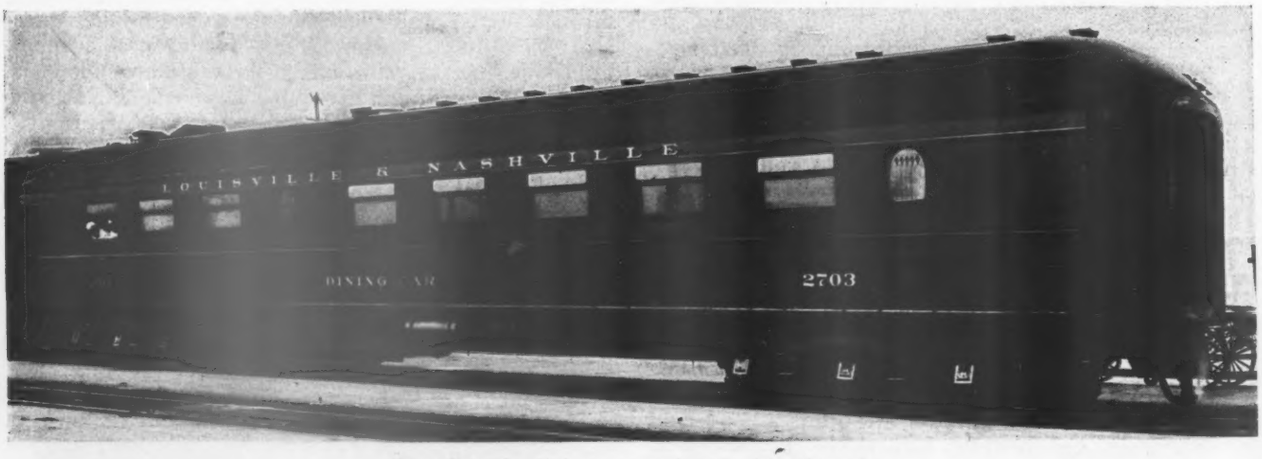
veniently shut off the outside air when desired and only inside air will be filtered and recirculated. No attempt is made to reduce the temperature of the air, except to secure comfort by the cooling effect of air motion. The volume of air flow may be adjusted by a center knob which controls the speed of the motor and fans.

The installation in the car window is comparatively simple. The cabinet takes up approximately the same space as the customary window screen and requires no change or alteration in the car except electric wiring. To secure the best results in a dining car it is recommended that a unit be placed in the window at each table and in one or two windows in the hallway at the kitchen end.

The outside panel is made of a single piece of sheet metal. It extends the entire width of the window opening and fits flush with the outside sash and back of the cabinet. This panel is bent over the top of the cabinet to fit under the lower rails of both sashes, and also bent under the Airgard to fit the slope of the sill to which it is fastened. Two inside panels fit flush with and under the inside window sash to close up the space at either side of the cabinet.

The Airmat filter sheet, which is a product of the American Air Filter Company, is impregnated with a special adhesive for trapping the dust particles. The countless tiny openings in the mat permit the air to pass through, but the dirt particles, such as soot, dust, and cinders, are enmeshed in the mazes of the fibrous mat. The filter sheets are changed when they become soiled to the point where the air flow is restricted. This is done two or three times a week, depending on the amount of dirt in the air on any particular run. These filter sheets are inexpensive, easily renewed and are discarded when soiled.

Airgards are designed to bring in a sufficient amount of outdoor air at maximum capacity to completely change the air in the car every two minutes. Each unit supplies from 20 to 200 cu. ft. per min. This rapid air movement tends to create a slight positive air pressure within the car which prevents infiltration of dirt or the



Exterior of a dining car equipped with Airgards

The motor and fans are mounted on a plate which can be easily removed through the front panel. This permits servicing without disturbing the cabinet or installation. The shunt-wound, 1/30-hp. motor consumes about 2 amp. at 32 volts, which is about the same as a 60-watt lamp. A sturdy storm-protection intake hood is attached to the outside of the cabinet. An air-stop, or damper, which is operated by a push rod, is constructed within this hood so that passengers can control the entrance of odors from the kitchen, since the air moves toward the kitchen and out through the kitchen ventilators. The rapid movement of air across the tables eliminates the objection to smoking in a dining car. The tests have shown that patrons, even when seated opposite to persons smoking at the same table, were not conscious of any tobacco smoke odor whatever.

The units can be installed at small cost without mechanical changes or alterations to the car.

North Western Compartment Cars for L.C.L. Shippers

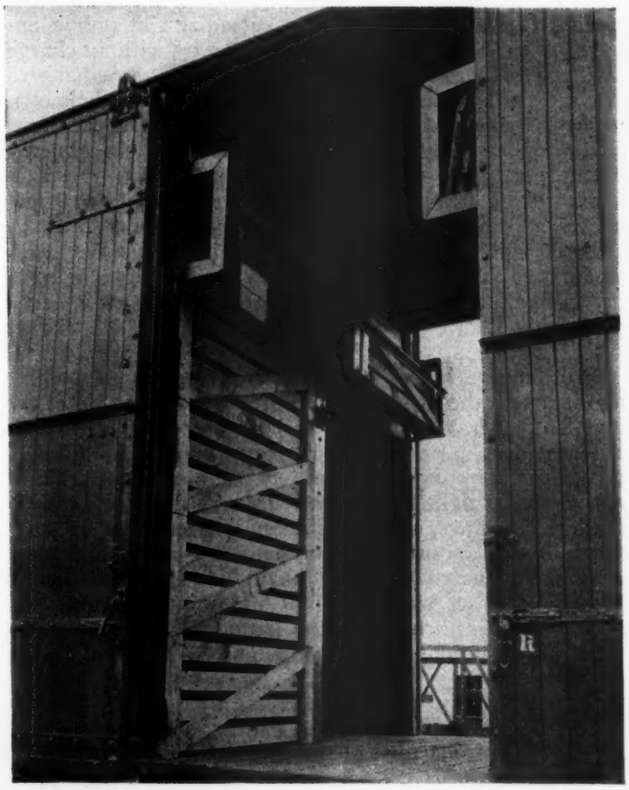
THE details of the installation of compartments in 10 Chicago & North Western automobile cars, referred to in a news item on page 214 of the May *Railway Mechanical Engineer*, are of more than ordinary interest. These cars, which, as stated, are in service between Chicago and Waukegan, Ill., Kenosha, Wis., Racine and Milwaukee, are each divided into four interior compartments, as indicated in the illustrations.

As originally used for automobile loading, the cars were equipped with large double-operating staggered doors. To provide for the new traffic use, the off-center doors are fastened permanently, leaving the two half doors, which are opposite each other and located nearest to the center of the car, available for loading and unloading. Two compartments are provided in each end of the car by means of double-board partitions nailed to 2-in. framing posts which are secured by angle brackets at the top and bottom, the partition extending all the way from the floor to the roof.

Permanent top boards cover the compartment ends, leaving a 7-ft. clear opening underneath. Each compartment gate is made in four sections capable of sliding vertically in angle-iron and cover-plate grooves, the cover-plates being omitted in the extreme upper position to permit moving each gate section horizontally, as it reaches that elevation, into a special storage cage above the compartment opening. As shown in one of the illustrations, standard car-seal fittings are provided for locking each upper gate to the center post when the compartment is in use.

By means of the construction illustrated, the gates are made a permanent part of the car structure and cannot be readily removed either carelessly or with malicious intent. Each gate section, 4 ft. 4½ in. long by 21 in. high, is made of 3¾-in. by ¾-in. oak slats with end battens and one cross brace of the same material. The battens are located 1¼-in. in from the ends of the slats which fit in the grooves mentioned to permit vertical sliding. The outside grooves are made of 4¾-in. by ⅜-in. steel plate, bent to a right angle 1¼ in. from one edge and bolted to the side door post, the 5-in. by ⅜-in. steel cover-plate, illustrated, forming the other side of a groove 1-5/16 in. wide by 1¼ in. deep. A similar groove is provided on each side of the center partition post. The storage cage is constructed of 3-in. by 3-in. by ¼-in. angles formed to the shape illustrated and applied by being bolted at the upper ends to the door or center posts and welded at the lower ends to the cover-plates.

Operation of loading C. & N. W. compartment car—Four-section gates shown supported in angle-iron cages above compartment openings



C. & N. W. automobile car converted to four-compartment box car—View shows compartment gate in closed position

The use of this type of sectional gate instead of a swinging gate permits loading all compartments simultaneously. On account of the simplicity and ease of installation of this equipment, it can be readily used to convert automobile cars to compartment box cars. The equipment can be removed with equal ease.

A Rival of Peter Cooper?—"The Pennsylvania Locomoter" is the subject of the latest centennial news item, in the railroad field, reported in current issues of the New York Evening Post. This was a steam locomotive, tried on the Newcastle & Frenchtown, as reported in the Evening Post of April 13, 1832. It is referred to as the invention or property of a Colonel Long. The weight of the locomotive and three cars was "upwards of ten tons." The time occupied in traversing 27 miles was two hours. The report seems to indicate that this railroad had been lengthened about 11 miles in the few weeks that had elapsed since the last preceding news item, which had told of the opening of the line for business, with horses as the motive power, for a trip of 16 miles.

EDITORIALS

The Brighter Side

"My center gives way, my right recedes; the situation is excellent. I shall attack."—General Foch.

Competition on the part of highway and waterway carriers has seriously embarrassed the railroads. These competing carriers are practically subsidized at public expense, since they use public rights-of-way without charge and are neither taxed nor regulated on the same basis as the railroads, which must provide and maintain their own rights-of-way and pay heavy taxes on capital, earnings, and property values as well, to help maintain governmental activities of all sorts. Fortunately, the tide seems to be turning and an awakened public, in some places at least, is beginning in no uncertain manner to demand fair treatment for the railroads. We who understand the railway problem ought to fight aggressively to educate the public to the facts in the case. Are you doing so?

* * *

Railroad employees in the state of Virginia 18 months ago started the organization of Railroad Employees' and Taxpayers' Associations, including in their membership local merchants and professional men, as well as railroad employees. Largely as a result of their activities the right kind of men were elected to the Virginia Legislature, and legislation was enacted to give the railroads a fairer deal in competing with other carriers. Similar associations have been and are being formed in other states and the movement promises to spread rapidly throughout the nation. More power to these organizations! Are you doing your part to promote them?

* * *

The Interstate Commerce Commission has maintained a peculiar attitude toward the railroads; instead of fostering them in the interests of the public welfare, it apparently seems to feel that its duty is solely to protect the shippers and the public from the railroads. Attention has been focused more and more in recent days upon this misuse of power by the Interstate Commerce Commission and there seems to be little question but that public opinion will force a more constructive attitude on its part. Are you helping to enlighten that part of the public with which you come in contact?

* * *

The Railroad Credit Corporation and the Reconstruction Finance Corporation have come to the financial aid of the railways and are assisting them in material ways to meet their obligations at a time when relief could not be expected from normal sources. More than this, the Reconstruction Finance Corporation has arranged to advance almost five million dollars to the New York Central to complete its West Side improvements, and 27½ million dollars to the Pennsylvania Railroad to assist in completing its program of electrification. These two latter projects, which will require the expenditure of monies far in excess of those advanced by the government, mean that many thousands of men will be employed by the railroads and that business generally will be stimulated because of contracts which will affect other thousands of workers.

* * *

Invention has been greatly stimulated during the depression, says a well known patent attorney, and as a result we may expect to see many remarkable developments in the engineering and industrial world within the next few years. Many such inventions relate to railway activities.

* * *

This machine age, with the intense mass production developments of recent years, has had a profound influence upon our economic, social and political life, and has made necessary radical changes in many of our functions. The railroads have been and will continue to be affected by these changes and in some respects, at least, must radically change their methods to meet the new conditions. New inventions, new practices must be adopted. Many improvements, some of which have been in a developmental stage for a long time, are now coming to a head and with the united and aggressive promotion of some of them, the railroads undoubtedly can stage a strong comeback in regaining part, at least, of the traffic which has been lost to competitors.

* * *

Pick-up and store-door delivery of freight, for instance, is being adopted in several places and may prove to be a large factor in offsetting competition on the part of the motor truck. Incidentally, innovations such as this are quite likely to be forerunners of radical changes in equipment design and methods of operation. We must be wide awake and keen to sense the need of such changes and meet squarely the new requirements.

* * *

The United States Supreme Court on May 24 made two decisions which promise to go a long way toward clearing up the problem of the use of highways by commercial vehicles, at least to a point where the different states can, if they so desire, enact legislation which will adequately control such operations. It affirmed the constitutionality of the motor vehicle regulatory law of Texas, prescribing size, weight and load limits for trucks of common, contract and private carriers; and also that of Kansas, which includes provision for the taxation and regulation in certain respects of private motor freight carriers.

* * *

Competition with the railroads on the part of other types of carriers has not until comparatively recently been taken seriously by the railroads. It is significant, however, that the traffic departments of not a few roads are awakening to the necessity of meeting such competition in a determined manner. All sorts of schemes are being tried in the attempt to give better service in handling both freight and passengers. This includes the speeding up of trains, the cutting out of inefficient practices and, particularly, as far as passenger service is concerned, providing more comfortable and convenient equipment and facilities and making special rates to attract the traveler.

* * *

Air conditioning of passenger cars is being adopted by more and more railroads. The Railway Age is authority for the statement that within a period of four months six railroads have authorized programs which will require the expenditure of $1,470,000. for that purpose—and this is only part of the story, since other

roads started earlier, or have since announced their intention of air conditioning some part of their equipment.

* * *

Too large a part of the car and locomotive equipment is lying idle or is not in usable condition. In spite of this the railroads in the first three months of 1932 spent over $141,000,000 for supplies and equipment, or at the rate of about $47,000,000 a month. While the figures are not yet available, there is no question but that the expenditures for April considerably exceeded this average figure.

* * *

This is a time of testing and of challenge. The clouds may seem dark and heavy—but there are also signs of better days ahead. Let us take new courage and do our full part in building up credit and confidence.

We Change Our Make-Up

With this issue of the *Railway Mechanical Engineer* we have made a slight change in the physical arrangement of the paper. Articles describing proprietary devices, materials and tools, which for many years have been segregated in the "New Devices" department, will henceforth be included in the other departments of the paper to which their subject matter is most closely related. Thus, articles describing devices or equipment for use on cars and locomotives will be included in the department at the beginning of each issue which is devoted to articles of general interest to car- and locomotive-department officers and supervisors. Those articles which describe new tools or equipment for use in the shops and enginehouses, or on repair tracks will appear in those departments devoted especially to matters of particular interest to the foremen in the car and locomotive departments, respectively. We are prompted to make this change to simplify the arrangement of the paper and bring together in one place all of the material in each issue pertaining, respectively, to locomotives and cars and to locomotive- and car-shop practice. The change is in arrangement only and not in the character or the balance of the material in the paper.

Milwaukee Gets Results In Packing Reclamation

One of the most interesting studies which it has been the privilege of the *Railway Mechanical Engineer* to present in recent months is that of the new journal-packing-reclamation plant of the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, Wis. This plant, with complete facilities for the mechanical reclamation of journal-box packing and the renovation of oil by the distillation process, was completed and placed in service March 16, 1931. During the latter half of March and the month of April, the plant operation was in more or less of a state of development and refinement, consequently, it was decided to have the *Railway Mechanical Engineer* study cover the period from May 1, 1931, to April 30, 1932.

The conclusion is drawn, based on well-substantiated figures, that in a year of drastic curtailment of most car-department operations, this plant has maintained its output and earned a return of 82 per cent on the investment, not counting a number of savings which, while entirely specific and tangible, are difficult to evaluate.

For example, in the course of the year's operation, the newly-renovated packing and oil has been quite generally distributed and applied in Milwaukee equipment, being thoroughly tested during several months' operation under winter temperatures and severe road conditions. It is a significant fact that the number of hot boxes in Milwaukee freight equipment dropped from 5,241 in 1930 to 2,490 in 1931 and to 311 during the first three months of 1932. Placing this performance on a mileage basis to eliminate the effect of reduction in business, the figures are 162,030 miles per freight-car hot box set out in 1930, 286,025 miles in 1931 and 462,802 miles in the first three months of 1932. When it is considered that this record was obtained during winter operation and with generally higher freight-train speeds, the performance is particularly creditable, both to the quality of journal-box packing, including the one-season oil, now used on the Milwaukee, and to the generally high standard of journal-box maintenance. That there has been no slighting of work in this important detail of car-department operations is indicated by the fact that the number of journal boxes repacked on the Milwaukee during the 12 months ending April 30, 1932, included 72,535 foreign and home cars, which was roughly the same number as was packed in the preceding 12 months' period.

Economies that are resulting from the installation of this new packing-reclamation plant, accompanied by the concentration of journal-box repacking operations at nine regularly-assigned points on the Milwaukee system, as compared with 63 former repacking points, are not like many of reductions of expenses which have been effected during the depression. When traffic increases with a resumption of business these savings will increase. They involve no debt of deferred maintenance to be paid in the future.

What Are the Real Costs?

Decisions on the part of railroad mechanical officers as to whether it is more profitable to manufacture, "reclaim" or to purchase in the open market many parts and devices used by a railroad are based upon cost analyses in which they feel they are justified in placing their entire confidence. Frequently specific instances arise, particularly under present conditions, which raise serious questions as to the accuracy of many of these cost studies. This has been true recently in connection with the operations engaged in on the part of many railroads under the guise of reclamation.

The operations of a railroad shop may be roughly divided into the classifications of repair work, manufacturing and reclamation, the latter term applying more directly to the efforts expended to restore certain parts and devices to their original state of usefulness. The same definition might be applied as effectively to repair work except that, in that connection, it is not customary to consider quantities as large as those usually dealt with in reclamation.

If we consider the evolution of reclamation work we will probably discover that at some point in the development of the idea it involved the utilization of some part of the excess capacity of a shop. The operation of a railroad, in times of normal business creates peak periods when it is necessary to maintain shop forces

somewhat in excess of the normal demands for output. This excess of man-hours in a shop naturally calls for some consideration of means of utilizing it to advantage. To some extent reclamation work was the result of the effort to utilize excess capacity. It was not, however, controlled as carefully as it should have been with the result that, having been able to build up what seemed to be a profitable operation by using the excess labor capacity with existing shop capacity many roads segregated the operations into separate departments and added shop facilities which naturally ran up that part of the real cost which is termed "overhead." Overhead expense in a manufacturing plant usually varies anywhere from 150 to 300 per cent of the cost of actual or "direct" labor and material. Many railroad cost accountants apply an overhead as low as 30 per cent. On this basis it is not difficult to see why decisions are frequently reached that it is cheaper to make or reclaim something than it is to buy it.

There has always been a real need for better railroad shop cost accounting methods and under present business conditions that need is more acute than ever before. There is daily evidence that the costs of performing the various operations involved in modern railroading are being given the most careful consideration. The real value of this present tendency depends, to a great extent, upon the methods used in compiling cost figures and finally in analyzing them. Decisions to manufacture or reclaim materials or parts in railroad shops might, in many instances, be entirely reversed were the railroad shop costs compiled and analyzed from the angle of a manufacturing plant and all of the real costs added in as they should be. Where a shop operation utilizes only the excess man-hours of labor normally existing in most shops and the excess capacity of existing shop facilities the product of this excess capacity may result in some saving to the railroad but when the manufacturing or reclaiming operation reaches a scale where added labor, facilities and supervision are required it may very easily be produced at a loss. The only way in which it may be determined whether or not an operation is profitable is to establish cost methods that produce real cost figures rather than the superficial estimates too often relied upon.

There is no better time than the present to consider carefully the fact that the real business of a railroad is to produce transportation at the lowest economical cost. Each maintenance method and operation should be weighed thoroughly in order to determine whether it is a primary part of the production of transportation or whether it might not better be left to outside agencies that are better fitted to perform the service for the railroad company.

Wanted—

A Motive-Power Policy

One of the most crying needs of American railroads is a motive-power policy.

Most motive-power department officers will recall how locomotives were purchased in the days before the war. Signs of an imminent increase in traffic led to an executive decision that more locomotives must be ordered immediately. Instructions were issued to the superintendent of motive power to prepare specifications and the mechanical engineer's office burst into fevered activity, including nights and Sundays. In a few days a specification was assembled in which the major emphasis was on the inclusion of the maximum number of the road's standardized details. Negotiations completed, the builder proceeded to lay down a locomotive assembled, as far as the road would permit, from details the patterns and designs for which were already available in his shop and drawing office. In due course the railroad received its new motive power, perhaps in time to assist in the movement of a new peak of traffic. Now and then some of the oldest locomotives in the inventory were slated for retirement, but usually with little relation to the purchase of new power.

With some exceptions in the case of individual roads, the marked increases in traffic to new record peaks, which formerly inspired the purchase of new locomotives, have not been in evidence for some years. Since the close of the war there has been a leveling-off in the growth of traffic and, in the case of passenger business, a heavy recession. The major attention of the railroads has been concentrated on improvements of road and yard facilities which have greatly facilitated the smoothness and economy of operation. In the meantime, deprived of the old urge for the expansion of their motive-power inventories, the railroads have drifted without a motive-power policy.

One fact in the old practice is significant. So far as it can be considered a policy, it was initiated by the executive and the service of the motive-power department seldom began until the decision had been made. Few motive-power officers considered it their function to initiate proposals for new motive power and frequently took little part is deciding on the general type of power to be purchased. Their duties were confined to matters of the details and proportions.

Future motive-power policies will have to be based on eliminating the costly effects of obsolescence. These effects arise from two causes. Advancements in the art of locomotive design and proportioning have been so marked in the past decade that the advisability of continuing the operation of locomotives over ten years old is questionable. Changes in the character of the service which the railroads must render have placed demands on the freight power for which the older locomotives are not adapted. The gradual replacement of drag freight service by scheduled freight trains and the continuous stepping up in the speeds of these trains requires a freight-locomotive performance which cannot be produced economically with locomotives having small driving wheels and inadequate boiler capacity.

The general lack of well defined motive-power policies at the present time is a challenge to the mechanical-department officers of American railroads. It is true that the decision as to a policy is the function of the executive. But what officer on the railroad is as well equipped as the head of the motive-power department to originate a program for the replacement of obsolete locomotives to meet the new operating demands and to take advantage of modern ideas as to design and proportioning? Such a program, carefully developed and planned for execution, say, over a five-year period, would give the executive the foundation he needs for the establishment of a well-defined motive-power policy.

The present situation offers to the motive-power department officer one of the biggest opportunities which has come his way in many a year. Like all opportunities, it must be seized; it will not wait. The officer without a program when business activity calls for an expansion of railway operations will have little time for planning. He will receive his orders and, irrespective of their soundness, will have to carry them out. The railroad will be the loser.

THE READER'S PAGE

"Believe It Or Not"

To the Editor:

The January 31, 1932, issue of the Kansas City Star published a sketch of a 4-6-2 type locomotive which was drawn by Ripley of "Believe-It-or-Not" fame. The following is Mr. Ripley's explanation:

Ten Cents Will Stop a Locomotive.—Despite the tremendous power of the modern iron monsters-of-the-rails, it is possible for ten small pennies to prevent one from moving. The greater part of the weight of locomotives such as I illustrate (about one-quarter million pounds) falls on ten of the wheels, whereas the tractive force of the locomotive is about 60,000 lb. Tractive force is closely allied to the drawbar pull of a locomotive and usually they are about equal.

If a penny or another obstacle of the same size be inserted directly in front of each wheel on the rail, the locomotive must raise its entire weight in order to move, and this is impossible for the most powerful steam locomotive ever made.

This looks to me as if Ripley were putting a lot of bad ideas into the heads of mischievous school boys. Can you stop a locomotive with 10 cents? How about it?

A Reader.

Is the Saving Justified?

To the Editor:

"The Price Will Be High," the editorial in the April issue of *Railway Mechanical Engineer* certainly made a thorough diagnosis of the methods of dealing with some mechanical department foremen.

There probably isn't a foreman who has not gone through the present period of reorganization, who has not felt the pangs of worry, discouragement and finally distress. Several months ago he ceased being an efficient foreman, a supervisor who previous to the present period had every reason to believe that his job was stable and that the work which he was doing was considered an asset to his railroad rather than an unnecessary expense.

When the "sand-house" rumors began to circulate which were to the effect that certain foremen were to be taken off their jobs and (if they had sufficient seniority) reduced to the rank of mechanic, did they put the same effort into their jobs or did they worry along with the workmen and wonder when the axe was going to fall on them?

These are the same foremen who, as stated in your editorial, were addressed by mechanical-department officers at the conventions of their associations only a couple of years ago and told they were the back-bone of the railroads and were the future master mechanics, general foremen and superintendents of motive power. Most of these foremen have, in addition to their practical training, studied hard during their spare hours off duty to promote themselves. They have subscribed for magazines, for the sole purpose of studying the shorter cuts to mechanical efficiency as shown by the various articles which are published and the numerous "shop kinks" which appear each month. They have enrolled in night schools and endeavored to compete with some of their more fortunate associates who were not compelled to start to work before completing an education. These foremen are now asking themselves whether or not they have labored in vain for the promotions which they finally received and which they have recently been deprived of. Are they to be reinstated when times are better and is the saving which the railroad company is realizing in dollars and cents justifiable in view of the fact that business is again going to demand a re-establishing of many of the supervisory jobs now being eliminated?

Just a Foreman.

The Kitchen Needs Attention

To the Editor:

Economy is undoubtedly foremost in the minds of railroad operating and maintenance officers during the present time of depression. Operating costs have been pared down in almost every conceivable form—train service curtailed; supervising forces reduced and salaries cut; repair and maintenance men dispensed with or hours reduced, and now wages of employees under contract reduced.

The enginehouse foreman is almost at his wits end at times under the above conditions to keep repairs up to the standards required by the I. C. C. inspectors under the law. Although faced with rigid instructions demanding economy on every hand, the foreman must maintain locomotives in "safe and suitable condition for service" according to the version in the I. C. C. regulations.

What a change has taken place in the past twenty years! A modern mammoth, with its parts of greater weight, being repaired in an enginehouse equipped only for the handling of obsolete power calls for bull strength and awkwardness in the n'th degree. Enginehouses without power trucks or hoists, removing and changing heavy repair parts which are being hauled around by the men on hand trucks, are certainly not conducive to economy.

Power not properly kept up represents a distinct loss of revenue. Steam-valve glands leaking, packing rings worn, engines out of square, leaky flues or units, leaks in air or steam-heat equipment, front ends not properly drafted or not kept tight, all use up fuel to no good purpose, which means wasted dollars. Engines kept "alive" unnecessarily or fired up too long before being required for service use up many tons of fuel before it is realized. We find it economical and a time saver to coal up the firebox immediately after the boiler staff has completed inspection and repairs. The boiler, being still warm, all moisture is quickly dried from the coal and, when ordered, the oil lighter "touches it off" in a few seconds.

Lights left burning unnecessarily, or a 100-watt lamp when a 60-watt, or perhaps even a 40-watt, would be equally serviceable, represent waste. A few lights thus used in a plant daily mean many dollars in a year. Again how many of the various office staffs realize that the steam heat supplied to them from the plant means dollars in the shape of fuel. Windows are thrown open beyond what is necessary for proper ventilation when the temperature becomes a little warm instead of curtailing the steam. Why expect the foreman at the

plant to heat the whole of that part of the state? Lines conveying heat to coach yards or distant buildings should be properly insulated and maintained free from leaks. Steam blower lines should be kept lubricated at the joints and free from leaks.

A first-class railroad with A-1 locomotives and cars which expects the mechanical men to get along and maintain service with obsolete equipment is like a modern hotel with an old-fashioned farm-house pantry as the sole means of supplying the orders of its guests.

GENERAL FOREMAN.

Vocational Education

TO THE EDITOR:

I read with considerable interest the article in the February issue by C. M. Drennan on "Teaching Air Brakes," and also the editorial concerning this article entitled "Vocational Education." Mr. Drennan outlined his method of teaching this very intricate equipment and it appears as though he has students who are far above the average in intelligence and understanding, or it may be, as the editorial states, its success is due to the instructor's practical knowledge and also his skill as a teacher.

I have had the opportunity of teaching air brakes for two years at a vocational school. The class consisted of locomotive firemen, mechanics and apprentices. My method of teaching was similar to the course as outlined by Dr. Drennan. In addition to his method, we used pamphlets furnished by the Westinghouse Air Brake Company and the "Air-Brake Catechism" by Blackall-Parke. Occasionally we used charts which are a part of the International Correspondence School course.

Prof. F. G. Higbee of the University of Iowa concludes that "The method of presenting facts to students by the lecture system is inferior to the textbook system. Students not capable of taking notes are not able to remember demonstrations without taking notes. After sufficient time for study, a class will demonstrate in one trial, if taught by the textbook method, that it has mastered the lesson, while three to five trials are required to reach the same state of perfection when instruction is by the lecture method."

H. G. Wells says: "The frank recognition of the book and not the lecture as a substantial basis of instruction releases the process of learning from its old servitude to time and place."

As a student and a past instructor of air brakes, I cannot agree with Mr. Drennan that his method of teaching is the best; I agree with the editorial on this matter. The more simple units as described in his procedure could be learned by lectures and blackboard drawings, but when his Unit No. 8 is considered, it is not feasible to consider the Drennan method.

The editorial goes on to state that here is a system of vocational training for the benefit of a single industry and of a limited number of its employees, the taxpayers footing the bill. Vocational training has many branches. Men and women are encouraged to enroll and prepare themselves for better positions in life, selecting the course which they may desire to pursue. The majority of these men and women were possibly denied this advantage because they are beyond the school age, or any other reason.

Is it not true that an educated man or woman is a better citizen than an illiterate one? Will not an education increase their earning capacity and incidentally improve their living conditions? Then, their children will be given an early education which they, the parents, were denied.

This brings us to the taxpayers who are paying the expenses of such a school. Considering the railroads, almost everyone is directly or indirectly benefited by the success of this industry. The taxes paid by the railroads in some cases are directly beneficial to whole communities. I am informed that 26 per cent of all taxes collected in this country is absorbed by public instruction. This being the case, imagine the educational facilities provided for by the railroads. In view of this fact, are not our employees, to say nothing of our children, entitled to share some of these advantages? Considering the number of students enrolled in vocational schools, the railroad employees are but a small percentage of the whole and do not the railroads pay most of the taxes for such instruction?

There is yet another phase to be considered in connection with this discussion. There are stockholders of railroad companies and other larger corporations and even small land owners, whose capital in investment is indirectly responsible for some of the taxes from which vocational schools are made possible. Their children want an education and a degree from some university. They select the university because it is more thorough and has more advantages than the vocational schools. However, such an education and a degree will not be furnished entirely by the taxpayers, their parents being a big contributor, but from private funds. Therefore, is it a fair proposition to require the university student to pay for his education because it is more thorough, while the vocational student is obtaining his at no expense other than the taxpayers'?

EDWIN G. JONES.

What! Are They *That* Dumb?

TO THE EDITOR:

The letter by B. T. on page 151 of the April issue of the *Railway Mechanical Engineer* makes interesting reading for a fellow foreman. My mind was at once carried back to the days of "Top Sergeant et al" and the stirring letters in the magazine of those times.

B. T. is apparently to be greatly pitied, assuming he has correctly cataloged Bill, Joe, Tommy, etc. Just imagine thirty-two standard rated mechanics of these modern times with all our efficiency and progress, all under the same foreman, and not one of them able to step into that foreman's shoes (according to B. T.), even after several years of experience!

Well, B. T., you are either a superman, or a failure as a teacher, or else the men must be 100 per cent dumb.

This world is largely what we make it. A foreman can educate, warn, penalize or discharge men as occasion demands. Surely, if he gives an opportunity, some responsive chord is struck in a gang of thirty-two men.

B. T.'s ideas of "what kind of stuff it takes to make a boss" may not be altogether up to the modern standard. Today, brains and education count and usually one man in ten, at least, responds to decent treatment and tactful, intelligent teaching. To be a successful foreman a man must be an organizer, approachable and diplomatic. He must be resourceful and a student of human nature. He should be a man as well as a foreman. And it is well for him if he has the name of being a square boss.

BOSS MEC HANIC.

With the Car Foremen and Inspectors

Convenient Equipment For the Rip Track

*By H. J. Quinnell**

SEVERAL car-shop devices developed and put into use during the past year at the Illinois Central shops, Paducah, Ky., are shown in the illustrations. These were suggested largely as a result of aggressive campaigns to promote safety first, waste elimination, avoidance of damage to tools and equipment, and increased efficiency. These devices, made for the most part from scrap or second-hand materials by the car-department forces, have proved an important factor in expediting car-repair work at this point.

Trestle for Truck Work and Wheel-Handling Device

The first illustration shows a horse or trestle arrangement, made up of scrap tubes with welded connections, for the removing and handling of truck sides when changing wheels on Bettendorf-design car trucks. This arrangement relieves all strains of heavy tugging and lifting, necessary when using only manual labor. It also reduces damage to car journals in removing the truck sides. Two men will remove and apply a pair of wheels in the same or a little less time than three men would do it without the use of this arrangement.

The trestle is equipped with two hand-operated 1,500-lb. ratchet lifts which are carried by rollers on the cross bar. The method of handling is plainly shown in the illustration. Owing to the ease of raising or lowering the truck sides and bolster, this work is readily done by one man with a minimum amount of physical effort.

Wheels are placed on and off of the rails by means of the pivoted lever arrangement, which is made of a substantial wood supporting base and a 6-in. by 6-in. timber, equipped with suitable irons. By the use of this device, two men lift the wheels off of the rails, turn and roll them over onto the wheel wagon shown on the side of the track. The construction of this wheel wagon, or trailer, designed to handle two pairs of wheels at a time is clearly indicated. There is also shown on the top of the truck side frames half-circular shaped sheets of soft copper. One of these is placed on each journal as an extra precaution to avoid damage to journals during the operation of changing wheels.

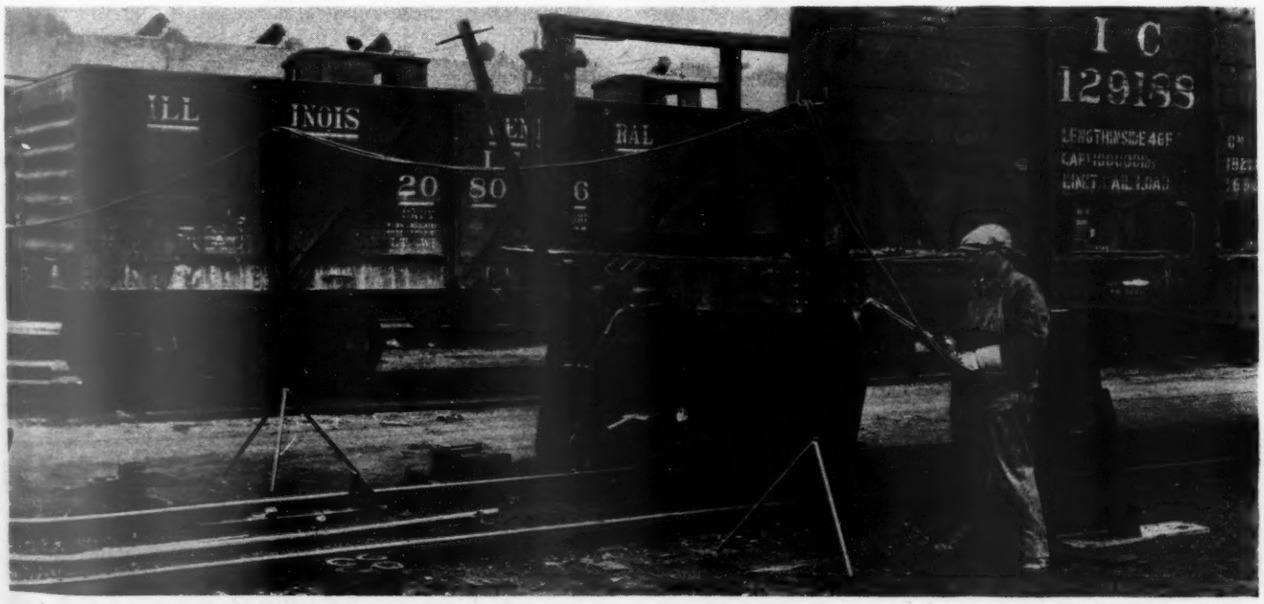
Convenient Scaffolding and Special Packing Wheelbarrow

The second illustration shows scaffolding hung over the side of a high-side gondola car, which is made of scrap wrought pipe with welded joints. Well-braced supports for the cross plank are provided at two elevations for greater convenience. Diagonal braces keep the base of the scaffold the required distance out from the car body. This device was originally designed to avoid accidents to men working on permanent scaffolding built up from the ground by the use of trestles or horses which might be disturbed or displaced by passing tractors, trailers, etc. Moreover, the presence of supporting trestles on the ground added to the congestion and caused more or less delays to tractor and trailer material-delivery equipment.

The metal holder, shown partly covering the car number, is used for holding cards for recording the work done and the time expended on the work. The flexible cover on this holder is provided for the purpose of keeping rain from damaging the records or wind from blowing them away.

The packing wheelbarrow at the side of the truck was

* Mr. Quinnell is general car foreman of the Illinois Central at Paducah, Ky.



How the hose-supporting standards and the draft-gear application device are used

View of scaffolding hung from the car and special packing wheelbarrow in use

designed for the purpose of keeping dust, dirt, etc., out of the packing while moving it between the car and the waste-soaking building. The top cover of the wheelbarrow is of a sliding arrangement designed to be opened only while filling the box. The front end of the metal box on the wheelbarrow is hinged to permit pushing the wheelbarrow up to the front of the oil box and removing packing from the journal box directly on to the table into which the hinged front of the wheelbarrow is converted. A pressure gun is used by the journal-bearing inspectors when applying graphite to the bearing before re-application of the journal packing. This gun was designed for keeping foreign matter out of the graphite.

Hose-Supporting Standards—Draft-Gear Application Device

The third illustration shows welded tubular hose-supporting standards which have proved a great convenience in keeping oxy-acetylene hose and air hose off the ground where it may be damaged. This device not only prevents damage to hose, due to being run over by trailers or other moving equipment, but saves much loss of time and interference with the work caused by car men and helpers stopping their work to lift hose extending across roadway and track while tractors and other equipment pass underneath.

At the end of the car is shown a built-up metal lever arrangement for placing friction draft gears in position at the draft-gear connections.

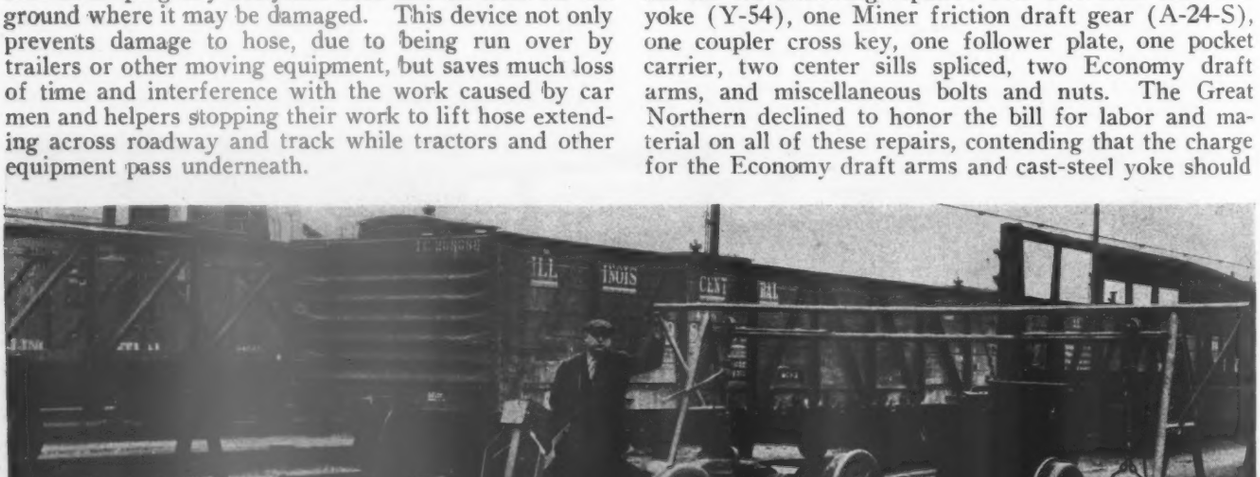
Between the rails is shown a long section of tubing with a flat cross section on an eye, used for placing in position the horizontal gear yoke used with a Farlow draft-key attachment. This was designed primarily as a safety measure to prevent injury to employees placing this member in position. The illustration also shows, on the ground between the rails, another tool or rest for the setting of an air drill while drilling holes in the underframe for brake-lever badge plates.

Decisions of Arbitration Cases

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Charge for Labor and Material Sustained for Wrong Repairs

On September 13, 1927, the Great Northern made improper repairs to Chicago, St. Paul, Minneapolis & Omaha car 27614 and attached to the car a defect card reading: "One complete Farlow draft gear A end should be Miner friction draft gear and steel draft arms." The owners corrected the improper repairs on November 25, 1927, and the defect card was returned to the Great Northern with the advice that the card should have included two center sills, framed for wood draft timbers, instead of steel draft arms. A new defect card was furnished as requested and the car owner rendered a bill for the following repairs: One Universal cast-steel yoke (Y-54), one Miner friction draft gear (A-24-S), one coupler cross key, one follower plate, one pocket carrier, two center sills spliced, two Economy draft arms, and miscellaneous bolts and nuts. The Great Northern declined to honor the bill for labor and material on all of these repairs, contending that the charge for the Economy draft arms and cast-steel yoke should



Various devices used to expedite freight-car truck work at Paducah shops

be confined to labor only. Its objection to the material charge for Economy draft arms and Universal cast-steel yokes was founded entirely upon its conception of the interchange rules in effect at the time of the repairs. It contended that there was no rule which protected the car owner for both labor and material in connection with defective or missing metal draft arms. It was never determined, the Great Northern claimed, what caused the draft rigging to pull out of this car, but past experience prompted it to assume that the defect was due either to failure of the draft arms or the bolts securing them. In either case, the Great Northern contended, the car owner is responsible, in so far as material is concerned. Relative to the Universal yoke, the Great Northern claimed that Rule 88 gives the repairing line the option of substituting other material instead of holding the car and ordering standard material from the owners. The repairing line, it stated, is obligated to the car owner for labor only. In its statement the C. St. P. M. & O. pointed out that the Economy cast-steel draft arms extended 25 in. back of the body bolster. The draft arms applied by the Great Northern did not extend back of the body bolster. The car owners contended that the defect card is authority for a charge for both labor and material.

The following decision was rendered by the Arbitration Committee November 5, 1931: "The defect card in question is full authority to bill for the material as well as labor. Decision No. 1451 is parallel. The contention of the Chicago, St. Paul, Minneapolis & Omaha is sustained." —*Case No. 1685, Great Northern vs. Chicago, St. Paul, Minneapolis & Omaha.*

Joint Evidence of Improper Repairs Sustained

Seaboard Air Line cars 98257, 98274 and 98745 were damaged in an accident on the Clinchfield. These cars were repaired by the latter at Erwin, Tenn., on January 10, 16 and 21, 1930, respectively, and "No bill" repair cards were included in the Clinchfield's bill 6690. A joint inspection was made of these cars within 90 days of their first arrival on the home rails, subsequent to their being damaged, and several defects were found which indicated that the repairs to these cars had been poorly and incompletely made. Joint inspection certificates and "No bill" repair cards were submitted to the repairing line and defect cards authorizing the completion and correction of the repairs were requested. The Clinchfield refused to issue defect cards. After several unsuccessful attempts to secure defect cards, the Seaboard included charges for correctly repairing these cars in its bill M-43629 against the Clinchfield according to Rule 13. The repairing line declined to pay its bill. The Seaboard in its statement pointed out that the Clinchfield loaded these cars out of Erwin and finally delivered all three cars to the Southern at Spartanburg, S. C. The cars were delivered to the home lines at Columbia, S. C., by the Southern, moved to their destination and were returned to Savannah, Ga., where joint inspections were made. The Seaboard contended that the nature and location of the defects left no doubt that the Clinchfield was responsible for the condition of the car when inspected at Savannah, although the repairing line claimed that its records showed that complete and substantial repairs had been made. The Clinchfield in its statement pointed out that it maintained at Erwin a modern car-repair shop with competent personnel and supervision. It contended that the A.R.A. rules did not provide for securing joint evidence to cover damage other than associated concealed defects on cars with visible unfair usage defects covered by the defect card as per section J, Rule 4. It claimed that joint evidence could be used only to establish the fact that wrong repairs existed as per Rules 12 and 13. It also argued that the damage, such as that shown on the joint inspection certificates, was cardable in interchange, to permit joint evidence to be used indiscriminately to establish the defective condition of a car would establish a precedent which would tend to nullify the effectiveness of Rule 4. The Clinchfield also stated that it could not understand how these cars could have passed interchange twice without the defects shown on the joint inspection certificates not being discovered. It contended that the bill rendered by the Seaboard on authority of its joint inspection certificates and the repairing lines billing repair cards is out of order, as Rule 13 does not provide for a bill except in the case of wrong repairs.

The Arbitration Committee rendered the following decision: "Joint evidence obtained per Rule 12 is final and, therefore, takes precedence over statement of repairing line that repairs were properly made. Car owner is entitled to a defect card from the Clinchfield for the improper work it performed on the three cars, as indicated by the joint evidence. As to defective parts mentioned in the joint evidence statements which are not covered by the billing repair cards, if the evidence indicates same to have been caused under any of the provisions of Rule 32, defect card should have been obtained in interchange. Decision No. 1609 applies." —*Case No. 1686, Seaboard Air Line vs. Clinchfield.*

Transporting Wheels On the D. & H.

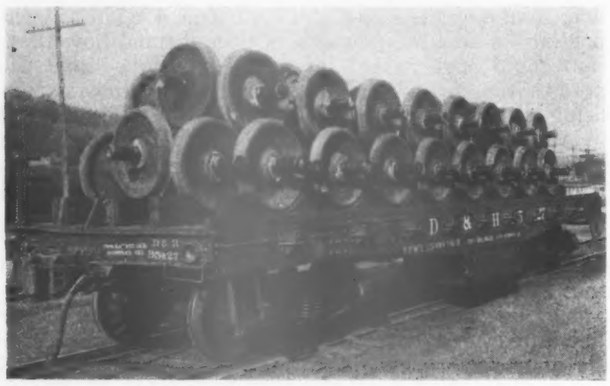
THE wheel car, shown in the two illustrations, is used by the car department of the Delaware & Hudson for the transportation of wheels from its wheel shop at Oneonta, N. Y., to the various repair points on the line.

The wheel car is a rebuilt flat car with square wood members bolted along the sides as shown. Four wheel blocks of heavy timbers, which are finished in the wood mill, are made with circular notches the entire length. Each of the arcs in the wheel blocks is cut to the same

Wheel car designed for maximum loading and safe transport of wheels

radius as the tread of the car wheel. Referring to the illustration of the empty car, the blocks on the left have notches cut for eight pairs of wheels, while the blocks on the right are cut for 10 pairs of wheels.

A well is provided along the center sill of the car with angle braces at each end in which a notched beam is placed to support the paired wheels loaded lengthwise of the car. This beam is notched for the wheel



Loaded wheel car used by the Delaware & Hudson

treads and flanged to prevent movement from buffing shocks.

Four tiers of wheels can be loaded on the car, as shown in the illustration of the loaded car. The eight wheels in the top tier loaded across the car rest on the bottom tier of ten and are prevented from moving to either side by the bottom tier of eight wheels. The top tier of wheels loaded lengthwise of the car are loaded to clear the bottom tier along the center of the car.

This arrangement of compact loading prevents any undesired movement of the wheels and insures delivery in the same condition as when they left the wheel shop. The journals are covered with a preparation to prevent rust and corrosion.

Repairing Pedestal Guides On Passenger Cars

THERE is no more unsightly condition on a passenger-car truck than a leaning or tilted journal box. A box that is worn in the pedestal guide until it leans is also dangerous to the extent that it causes uneven distribution of the weight of the car on the journal bearing and in many cases causes the journal bearing to lift up on one side permitting waste grabs to form and cause hot boxes.

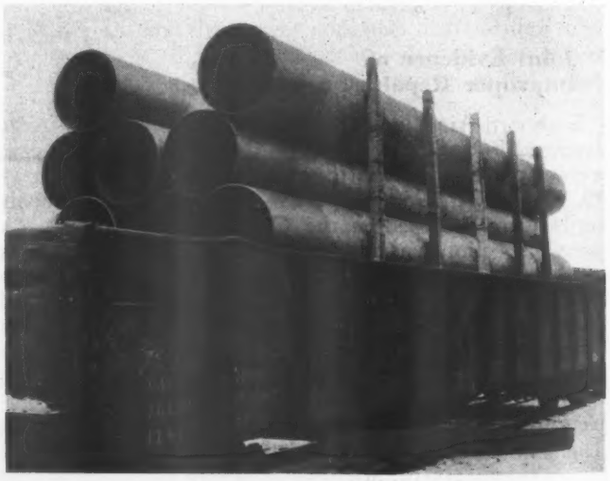
Passenger-car journal boxes being milled in sets

It is not necessary to scrap journal boxes that are worn slightly as they can be placed on a milling machine. The surface of the guides are leveled up and metal liners can be welded to each side of the box, thereby building up the surface of the box to its original dimensions. The metal liners can be of $\frac{1}{16}$ in., or heavier sheet steel and can be spot welded in place.

The illustration shows one complete truck set of journal boxes being machined at one time. This will insure the same amount of metal being removed from each box and will permit the same sized liner being applied to each box on the truck. It will also speed up the application of the liners making it unnecessary to gage the liners used on each box in order to bring the pedestal guides to the original dimensions.

Method of Loading Wrought Iron Pipe

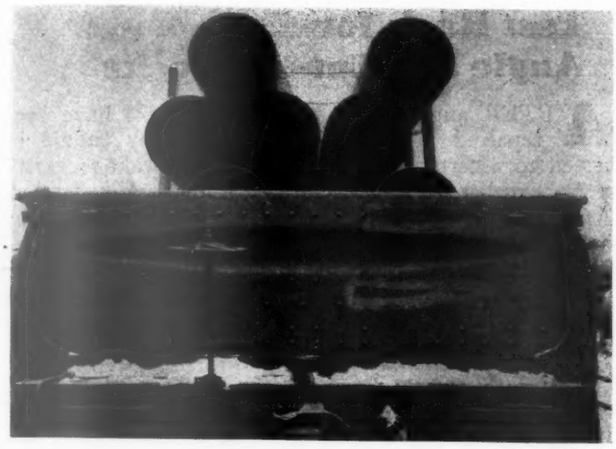
AS a general rule the car inspectors find that shippers are willing and frequently anxious to place lading on open top cars in such a manner as to comply with the A.R.A. loading rules in order to prevent delays to the shipment as well as damage to the lading due to the shifting of the load or accidents which improper loading are liable to cause.



Loaded in this manner the pipe caused unequal strain on the side stakes

In many cases shippers do not have a copy of the loading rules and instead of asking advice from the railroad they offer the loads for movement in much the same manner as is shown in the accompanying illustrations. In this case eleven 30-in. sections of wrought-iron pipe are loaded in such a manner as to cause a strain on the top of the side stakes on one side of the car. This would probably cause them to break while the load was being handled in a train and not only cause a delay to the train but be the cause of an accident.

The load was adjusted by placing the one section of pipe which was leaning against the side stake, in the same position as the top section of pipe on the left hand side of the car. After it was secured with binder wire



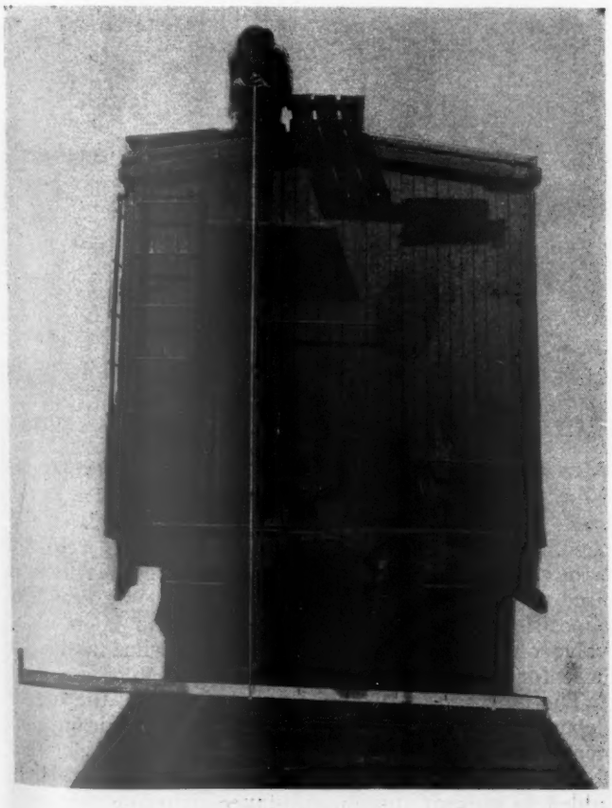
The pipe on the right was moved over to the left to balance the load

the load was checked at its destination and found to be in good order.

Shippers have loaded a number of similar shipments in the manner suggested and have been well satisfied with the condition of the pipe after it arrived at destination.

Device for Measuring High Cars and Loads

THE car inspectors, especially at one-man points or at places where there is but one man employed on a shift, often find it difficult to get the actual, or even an accurate, measurement of an open load on a flat or gondola car, or a high box car unless they can secure the assistance of someone to hold the end of the tape.



Gage for measuring the height of a car

A car inspector on an eastern railroad found himself handicapped in performing this job and designed the device as shown in the illustration. It consists of a piece of yellow pine ¾ in. by 2 in. by 11 ft. which is marked off in feet and inches. One end is provided with a metal stop used for measuring the width of the car or load, the dimensions being taken from the calibrations on the straight edge. At each foot mark a small brass hook is inserted so that the metal ring on the end of the tape can be attached even with the top of the rail. This will enable the inspector to measure the height of any part of the car or load.

The straight edge must be made from straight-grained and dried lumber as it frequently must be used during rainy weather, and even then will sometimes warp unless reinforced with a metal (preferably aluminum) stiffener on the narrowest edge.

Questions and Answers For Air-Brake Foremen

Following is the ninth of a group of questions and answers selected from the instruction pamphlet recently revised by an eastern road:

Q.—What may cause compound compressors to stop when 40- or 50-lb. main-reservoir pressure is obtained? A.—Defective governors.

Q.—What may cause an air compressor to stop when a main-reservoir pressure of 50- to 70-lb. is obtained? A.—Defective high-pressure air piston or discharge valve stuck open.

Q.—May the defects mentioned in the two preceding questions prevent a steam compressor from starting when the compressor throttle is open? A.—Yes.

Q.—If a compressor does not compress air while running, what defects are indicated? A.—Defective inlet valves, restricted or obstructed inlet ports or strainers, defective air piston ring or leaking air cylinder, excessive air leakage or open cocks.

Q.—What may cause steam blows in compressors? A.—Broken or worn high- or low-pressure steam-piston packing rings, broken or worn main-valve piston rings, leaks in the top steam-cylinder gasket or worn main slide valve or seat.

Q. What may cause a compressor to overheat? A.—Leaky air piston rings (particularly high-pressure air piston rings in compound compressors), badly worn air cylinders, discharge valves that leak or have insufficient lift or restricted air passages, inlet valves that leak or have insufficient lift or restricted air inlet passages, leakage at the stuffing box or any other point in the air cylinder, excessive speed for long periods or lack of lubrication.

Q.—Why are leaks in the compressor steam-supply line objectionable? A.—They will cause loss of oil and in turn cause the compressor to groan.

Q.—What would be the effect of leaks in the air-cylinder oil-cup piping or an obstruction in or between the oil cup and air cylinder? A.—They will prevent lubrication and cause groaning.

Q.—Explain how to determine an obstruction between the oil cup and air cylinder? A.—Remove the filling cap and observe whether or not air is forced out of the cup while the compressor is working. To detect leakage in the oil-cup piping, coat the oil pipe with soap suds.

Q.—Explain how to determine whether or not the discharge valves are leaking? A.—Close the compressor throttle when 40- to 70-lb. main-reservoir pressure is obtained, remove the high-pressure air-cylinder oil cup and the plug in the bottom head of the high-pressure air cylinder. If air is discharged at either opening a defective valve is indicated.

Q.—Explain how to determine whether the intermediate valves are leaking? A.—With 40- or 50-lb. main-reservoir pressure, close the compressor throttle, remove the low-pressure air-cylinder oil cup and the plug in the bottom of the low-pressure cylinder. In either case, air leaks at the top or bottom openings will indicate corresponding defective air valves.

Q.—Explain how to test the inlet valves for leaks? A.—Run the compressor at a speed of about 100 strokes per min-

ute, noting if air passes back through the valve when the piston moves toward the valves being tested.

Q.—What are the requirements with respect to steam-compressor governors? A.—They should permit the compressor or compressors to start with a reduction or increase in main-reservoir pressure not to exceed 3 lb.

Q.—When should air discharge at the air-vent port? A.—When standard main-reservoir pressure is obtained.

Q.—What should be observed with respect to the steam-vent port? A.—That it is open and leakage therefrom is not excessive.

Q.—What should be noted with respect to electric-compressor governors, or the compressor switch? A.—That the fingers are making proper contact, the compressor-finger adjusting screws are properly set, and that the air compressors start within 2 lb. above or below the standard settings for electric locomotives.

Q.—Where two or more electric compressors are used in conjunction, what is required? A.—That they start and stop simultaneously.

Q.—What should be noted with respect to master governors? A.—That the snap switch controlling the battery current for the magnet of the compressor switch is closed and that the master governor fingers make proper contact.

Q.—What should be noted with respect to the quick-application and release valve, when used? A.—That it opens at approximately 80 lb. and closes at approximately 60 lb. main-reservoir pressure.

Q.—What are the probable causes for improper functioning of steam-compressor governors? A.—Regulating spring out of adjustment, diaphragm valve too long, governor not correctly piped, governor pipe or strainer obstructed, cut-out cock closed, steam portion damaged, defective governor piston ring, steam or air vent port obstructed, defective diaphragms, obstructed passage beneath the diaphragm valve or steam valve held off the seat by scale.

Q.—What will be the effect of the steam-vent port obstructed and the top steam-valve seat leaking? A.—Boiler pressure will be present under the governor piston and will hold it in its upper position, and the steam valve open. Under these conditions main-reservoir pressure will rise above standard.

Q.—If the steam-compressor governor fails to function when the main-reservoir pressure is more than 3 lb. above or below the standard setting, what difficulty may exist? A.—Diaphragm valve too short or leaking, dirt on the seat, air vent port obstructed, excessive governor-piston friction, steam portion damaged, cylinder out of round or tapered.

Q.—What is indicated by leakage from the steam-governor vent port when the compressor is running? A.—The top steam valve seat is leaking.

Q.—What is indicated by leakage from the steam-governor vent port with the compressor stopped? A.—A loose fit of the governor piston stem in the bushing.

Q.—What may cause failure of an electric compressor or compressors to start when the main-reservoir pressure is within 2 lb. of standard cutting-in pressure? A.—Insufficient range of pressure between the cutting-in and cutting-out point, improper adjustment of the governor or master-governor cutting-in regulating spring, leaking cutting-out valve caused by defective seat or foreign matter between the valve and seat, defective double piston rings, high friction of the piston and slide valve, improper adjustment of the governor contact fingers or related adjusting screws, open master-governor snap switch or canopy switch, open governor circuit, blown fuse or open circuit in the compressor-switch magnet.

Q.—What is the proper range between the cutting-in and cutting-out pressure? A.—15 lb.

Q.—What may cause an electric compressor or compressors to fail to stop when the main-reservoir pressure is within 2 lb. of the standard cutting-out pressure? A.—Insufficient range of pressure between the cutting-out and cutting-in point, improper adjustment of the governor or master-governor cutting-out regulating spring, leaking cutting-in valve, defective double piston rings, high friction of the piston and slide valve or a grounded or short-circuited compressor governor or compressor switch, grounded compressor-switch magnet or grounded or short-circuited master governor.

Q.—What will be the effect of a defective seat or foreign matter between the valve and seat of the cutting-in valve? A.—Electric compressor or compressors may stop when the main-reservoir pressure is within 2 lb. of standard cutting-out pressure.

Q.—Within what pressure of the standard feed-valve setting should brake-pipe pressure be maintained? A.—2½ lb.

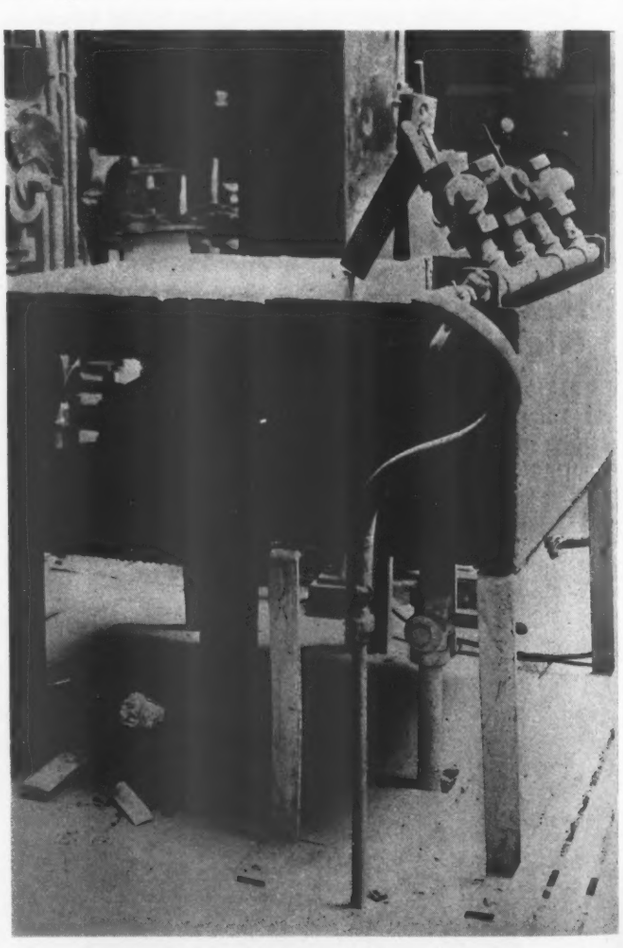
Q.—How is the sensitiveness of feed valves determined? A.—By applying a test device to the brake-pipe air-hose coupling with the angle cock open, brake valve in running position and the pet cock of the test device in open position.

Test Rack for Angle and Cut-Out Cocks

AFTER angle cocks and cut-out cocks have been repaired in the air-brake shop they should be tested to ascertain whether or not any leakage exists.

An excellent test rack is shown in the illustration. After the angle or cut-out cocks have been repaired by having the seats ground-in, four are attached to the 1¼ in. nipples on the rack and air pressure applied. The rack, with the four angle cocks is then turned downward and the entire bodies of the cocks are immersed in water. Should any leakage develop they are removed, re-ground and the test repeated.

The rack consists of a group of 1¼-in. pipe nipples and pipe tees, the number depending upon the number of angle or cut-out cocks which are to be tested at one time. On one end is a pipe plug to which is welded a wrought-iron handle about 12 in. in length which is used to turn the rack downward into the water. The opposite end of the rack is equipped with a ¾-in. globe valve or cut-out cock, to which is attached a flexible hose for supplying air pressure.



After the valves are mounted they are immersed by turning the entire group down into the tank

The tank can be of any depth desired and the length dependent upon the length of the rack. A drain connected with the sewer should be provided in order that the water can be changed each day and a fresh supply added to prevent foreign substances entering the angle or cut-out cocks as they are being tested.

In the Back Shop and Enginehouse

The Technique of Bending Wrought-Iron Pipe

MOST of the difficulties encountered in bending pipe come through a lack of appreciation of what happens to the pipe during the operation. Pipe bending is pipe stretching. Recognition of this fact and the use of a technique that takes it into account is the first step in successful bending. The fact that pipe bending is "pipe stretching" is well demonstrated graphically by an example.

Take a deck of cards and bent it into a semi-circle. From the inside to the outside of the bend the end edges of each card step back from the edges of the preceding card. If the deck is gripped tightly at the ends to prevent slipping and then bent, no step back of the edges is permitted. The cards on the inside, restrained from

Top and Bottom — Four steps in the hot bending of a section of locomotive piping

Left — These bends are typical of many that are made in railroad shops

pushing down, must buckle to take up their length in the shorter inside radius. The outer card remains unchanged. This is illustrated in Fig. 1 (A and B). If an elastic deck were gripped tightly at the ends to prevent slipping (as in the second trial bend) and then bent, the cards on the outer portion of the deck would stretch and thin out. The cards on the inner portion, instead of buckling, would compress and thicken. There would be one card somewhere near the middle of the deck that would remain unchanged. All cards outside of it would be stretched, all cards inside would be compressed. The unchanged card would be at the neutral axis.

If all the cards in the deck were eliminated excepting

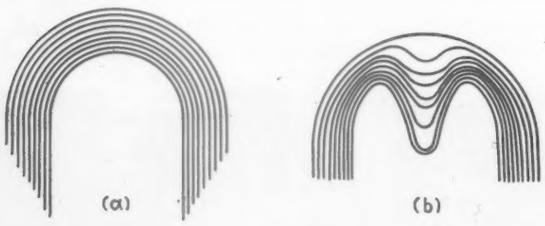


Fig. 1—(a) This illustrates what would happen were all sections of a pipe free to move—(b) When the ends are gripped tightly the inside wall must buckle when bent unless the outside wall stretches

the inner and outer ones, these two might be considered as representing the inner and outer walls of a pipe. Since the metal in the pipe is a unit mass, it is obvious that slip cannot occur along layers or fibers. When the pipe is bent, the necessary change in length of the pipe must be accomplished by the stretching of the outer wall and (to a limited extent) by the compression of the inner wall. This stretching and compression will be accompanied by thinning and thickening of the walls.

Thinning the pipe wall will, of course, weaken it; thickening strengthens it. Ideal bending, therefore, would leave the outer circumference unchanged and shorten or compress the pipe on the inner radius, thickening the inner wall.

In commercial cold bending, however, there is very little upsetting or thickening of the metal on the inner curvature. Practically all of the change in length caused by the bending must be taken care of by the metal stretching and thinning on the outer curvature and by the pipe flattening slightly. The extent to which this stretching can be carried determines the closeness of the bend which can be made.

Factors Involved in Bending

Stretch—The amount of stretch involved in bending is affected by two factors. First—for a given size of pipe, the stretch increases as the diameter of the bend is decreased. The second factor which affects the stretch involved in bending is the diameter of the pipe. For a bend of given diameter, the stretch increases as the pipe size is increased.

Stretch Distribution—The problem of pipe bending would be much simplified if the stretch distributed itself uniformly around the bent portion. The stretch, however, tends to concentrate at the central portion of the bend. This tendency is aggravated by improper bending practice. Successful bending demands that no portion of the pipe shall be stretched beyond the safe maximum, which the aim of all good bending practice is to distribute the stretch so that the elongation in each individual section of the bend approximates, as nearly as possible, the average elongation throughout the entire bend.

Essentials of Good Bending Practice

Good bending practice by either hand or machine must conform to two requirements:

1. The stretch must be applied successively to small local sections of the bend.
2. The stretched or bent zone must then be advanced out of the bending force. No zone should, after bending, be subjected to any further stretching or bending force.

Properly designed machines automatically meet these requirements. Generally, the pipe is clamped at the leading end and is pulled, or pushed, around a bending sheave. The straight trailing end of the pipe feeds forward, to be progressively subjected to the bending

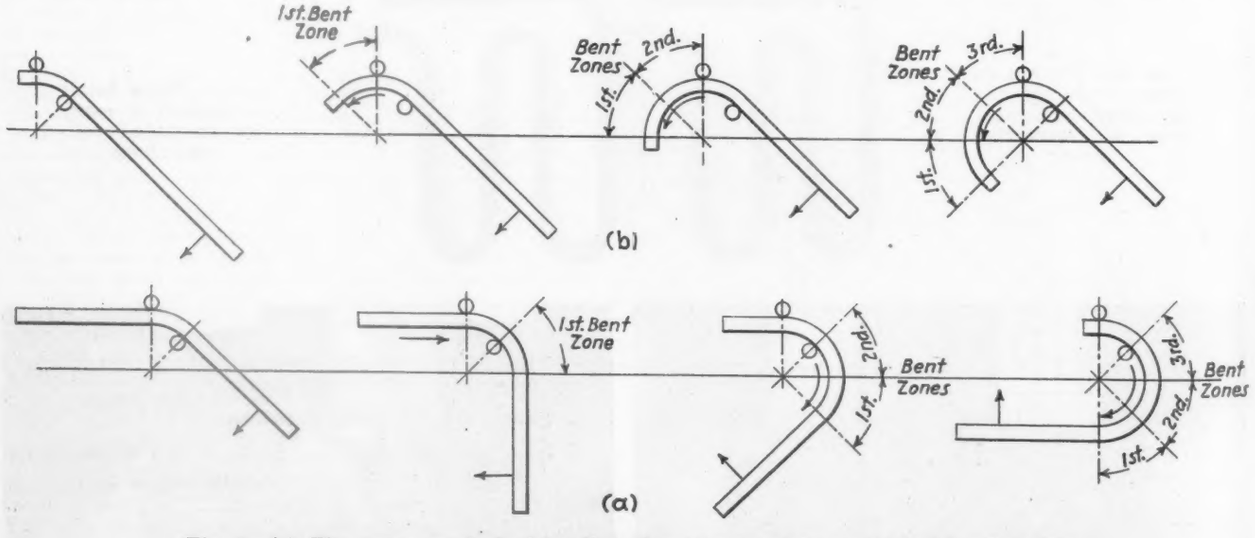


Fig. 2—(a) The wrong method of bending pipe; (b) the right method of bending pipe

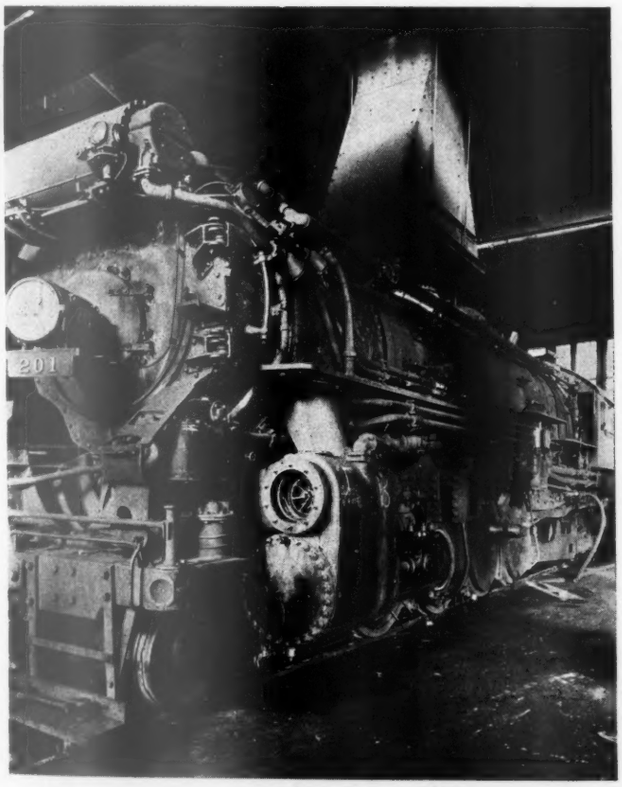
action. Some means, such as a follower block, is used to provide a bearing for the unbent portion of the pipe and to establish the necessary pressure at the point of the bend.

Hand Bending—Hand bending varies between such wide limits that it is difficult to lay down a specific set of rules. One frequent source of unnecessary bend failures is that of the workman starting the bend at

the near end, instead of the far end, and working toward the far end. This practice is illustrated in Fig. 2 (a). Note that, after a short section is bent, it is not advanced out of the bending zone; instead it is subjected to further strain and bending, because it forms part of the lever arm on which the workman exerts the bending pressure. This results in stretching the first bent zones more and more, as each successive bend is made and usually results in failure—either while the work is progressing or while the pipe is in service.

In the right method, the bend is started at the far end of the pipe and the pipe is fed away from the operator. This method is shown in Fig. 2 (b). It will be seen, by referring to this illustration, that after each zone is bent, it is advanced out of the bending zone. It is not subjected to any further strain or bending because it does not form part of the lever arm; the part of the pipe being used for leverage is perfectly straight at all times. As a consequence, if the initial stretch in each zone is kept to a safe limit, the bend will not fail.

Where sand filling is used in making bends, the ratio of circumference to pipe diameter given in Table I must be increased. Sand filling preserves the original bore diameter, preventing any flattening of the outer



The piping of a locomotive involves some intricate bending work

wall. This results in a considerable increase in the stretch necessary to permit the bend to be made, necessitating the use of a larger bend diameter.

In both hand and machine bending, it is important that the force which does the bending should be applied as a steady pressure and not as a sharp blow, or impact. In the thickening and thinning of the pipe wall which accompanies bending, there is an actual flow of metal—promoted by uniformly applied bending pressures. This uniform flow of metal is not possible with the application of any irregular force or sudden bending pressure since it tends to cause excessive localized thinning of the pipe wall and eventual rupture. The use of a steadily applied bending force retains more of the original strength of the pipe by permitting the automatic tendency of the metal to thin uniformly. This results in a maximum wall thickness and consequently greater strength at the bend.

In bending any pipe to a short diameter, the thickness of the outside walls is materially diminished; and it is the minimum thickness of a pipe wall that determines that pipe's resistance to corrosion, its ability to carry pressure and the length of its life. In cases where the stretch in portions of the bend runs up to 50 per cent, the wall thickness may be only one-half of what is was originally. Thus, the life expectation of the pipe would be one-half or less of what the life expectation of an unthinned pipe would be.

Because of the thinning action (which is present in all metallic pipes) the use of extra heavy pipe is recommended to compensate for the thinning in short bends. Sometimes changes in initial design can be made which will permit the use of a greater bend diameter and consequently less thinning. Sometimes this decrease is sufficient so that standard, rather than extra heavy pipe, can be used with considerable saving. In any case, the larger the bend diameter (and consequently the less the thinning) the greater the potential life of the pipe.

In railroad service it is frequently necessary to bend pipe to a very short diameter to meet limited space restrictions. It is important to make these sharp bends without increasing frictional flow resistance in the pipe by the introduction of internal obstructions from buckling or excessive flattening at the bend.

Some idea of the minimum diameters to which the sizes of pipe most frequently used in railroad service can be bent is given in Table I. This tabulation is for extra heavy pipe sizes since this is the weight of pipe most commonly used in railroad work. The same figures apply for standard weight pipe excepting for pipe sizes of 1½-in. or larger. The relatively thinner walls (in relation to the diameter of the pipe) of both standard and extra heavy pipe show a greater tendency to collapse in pipe sizes of 1½-in. and over so that a slightly greater ratio of bending diameters must be followed in these areas. The increase in diameters is somewhat greater for the standard weight than for the extra heavy pipe for these larger sizes.

Table I—Minimum Cold Bending Diameters—Extra Heavy Wrought Iron Pipe

Pipe size	Pipe O.D.	C. to C. Dia. of bend	Ratio-Dia. of bend to pipe O.D.
½ in.	0.840 in.	2.8 in.	3.33
¾ in.	1.050 in.	3.5 in.	3.33
1 in.	1.315 in.	4.3 in.	3.28
1¼ in.	1.660 in.	5.5 in.	3.31
1½ in.	1.900 in.	6.2 in.	3.26

Hot Bending

A large railroad shop reports the successful hot bending of 2½-in. extra heavy wrought iron pipe through 80 deg. to a 6-in. bending diameter. This is a ratio of bending diameter to pipe outside diameter to 2.08 to 1 and is a sharper bend than is ordinarily recommended, but it illustrates the bending possibilities.

A study of hot bending of wrought iron pipe indicates that the safe minimum hot bending ratio is one-third less than for cold bending, or 2.2 times the outside pipe diameter for 4-in. pipe and smaller sizes.

To obtain the best results with hot bending the following conditions should be observed:

1.—Heat to uniform temperature. Even slight variations in temperature not visible to the eye would be sufficient to

localize the bend in hot spots and cause premature tearing of the pipe because of uneven distribution of the elongation.

2.—Be certain to heat sufficient length of the pipe amply to cover the bend section. Neglect of this will result in concentration of the bend on a small portion of the circumference.

3.—Proper bending temperatures are extremely important. The greatest ductility is displayed at 1,300 deg. to 1,350 deg. F. It is better and much safer to underheat rather than run the risk of overheating in an effort to obtain the maximum ductility. Higher temperatures introduce a critical range in which hot bending should never be attempted.

4.—Bending machines of the bulldozer type are very unsuitable because of the restriction of the free flow of the metal caused by the tight gripping of the pipe. The best machine is one which bends a portion of the pipe and then completes the bend without throwing any strain on that portion already bent.

5.—Heating eliminates the automatic tendency of the stretch to equalize such as occurs in cold bending. Consequently it is most important to bend the pipe progressively.

Babbitting Crossheads And Crosshead Shoes

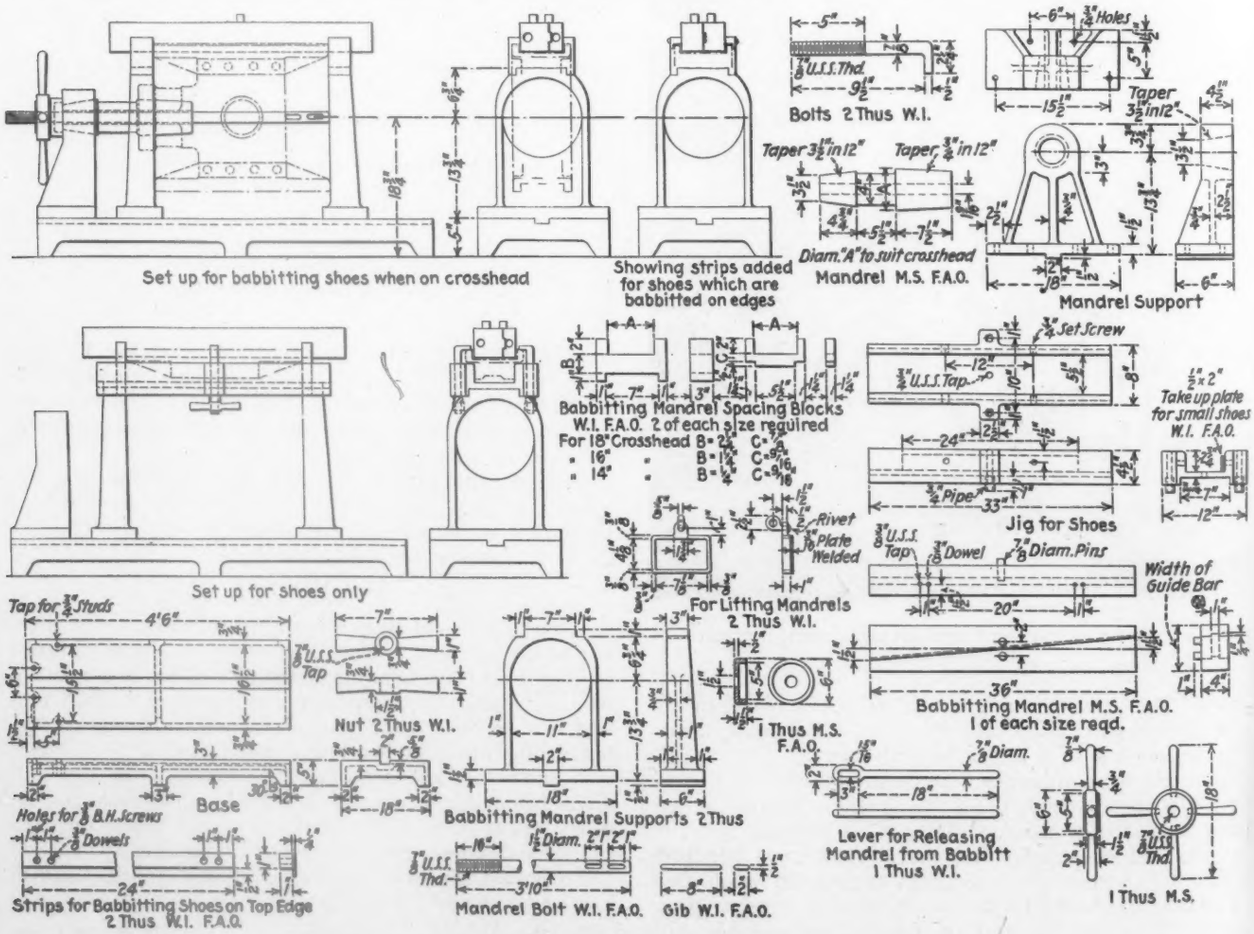
SHOWN in the drawing are the details and assembly of a jig for babbitting crossheads and crosshead shoes. The base, mandrel supports and jig for shoes are of cast iron, while the remaining parts are made from wrought iron and machine steel.

This jig is designed for 18-in., 16-in., and 14-in. crossheads. Dimensions *B* and *C* vary according to the size of the crosshead, as shown on the drawing. Dimension *A* on the mandrel spacing blocks is made to suit the width between the guide bars. When babbitting a crosshead an allowance of ⅛ in. must be added to the dimension for *B* and *C* for machining the babbitt. For example, for an 18-in. crosshead *B* should be poured to 2⅜ in. and *C* to 1 in.

With this jig it is possible to babbitt shoes alone or assembled on the crosshead. When assembled, the crosshead is fitted to the mandrel support and tightened by means of a through bolt and screw which is provided with four handles for turning. The mandrel bolt is provided with two rectangular holes for a ½-in. by 2-in. by 8-in. gib. The crosshead mandrel is tapered on the crosshead end ¾ in. in 12 in., with the large diameter *A* made to suit the crosshead. The base of the jig is provided with a ⅝-in. by 2-in. groove along the center in which ½-in. by 2-in. tongues along the bottom of the mandrel supports are fitted. This keeps the supports in perfect alinement on the base.

When babbitting shoes only, the shoe is clamped to the jig by means of two ⅞-in. L-head bolts for which clamping nuts with two handles for turning are provided.

The babbitting mandrel is made in two wedge-shaped pieces, tongued and grooved together. Two ⅞-in. dowel pins are located as shown. After the babbitt has cooled, the lever for releasing the mandrel from the babbitt is placed over the dowels. A slight turn of the lever to the right releases the mandrel from the guide bars and face of the shoe. Two lifting "rings", 4⅛ in. by 7⅛ in., are provided to lift the assembled babbitting mandrel to position in the shoe. Strips for babbitting shoes on the top edges are also provided.


Set up for babbitting shoes when on crosshead
Showing strips added for shoes which are babbitted on edges
Bolts 2 Thus W.I.
Taper 3½" in 12"
Taper ¾" in 12"
Diam. "A" to suit crosshead
Mandrel M.S. F.A.O.
Mandrel Support
Set up for shoes only
Babbitting Mandrel Spacing Blocks W.I. F.A.O. 2 of each size required
For 18" Crosshead B = 2⅜ C = 1
" 16" " B = 1½ C = 9/16
" 14" " B = ½ C = 9/16
Rivet Plate Welded
For Lifting Mandrels 2 Thus W.I.
Jig for Shoes
Take up plate for small shoes W.I. F.A.O.
Width of Guide Bar
Babbitting Mandrel M.S. F.A.O. 1 of each size reqd.
Tap for ¾" Studs
Base
Holes for ⅝ B.H. Screws
⅜" Dowels
Strips for Babbitting Shoes on Top Edge 2 Thus W.I. F.A.O.
Nut 2 Thus W.I.
Babbitting Mandrel Supports 2 Thus
Mandrel Bolt W.I. F.A.O.
Gib W.I. F.A.O.
1 Thus M.S. F.A.O.
Lever for Releasing Mandrel from Babbitt 1 Thus W.I.
1 Thus M.S.

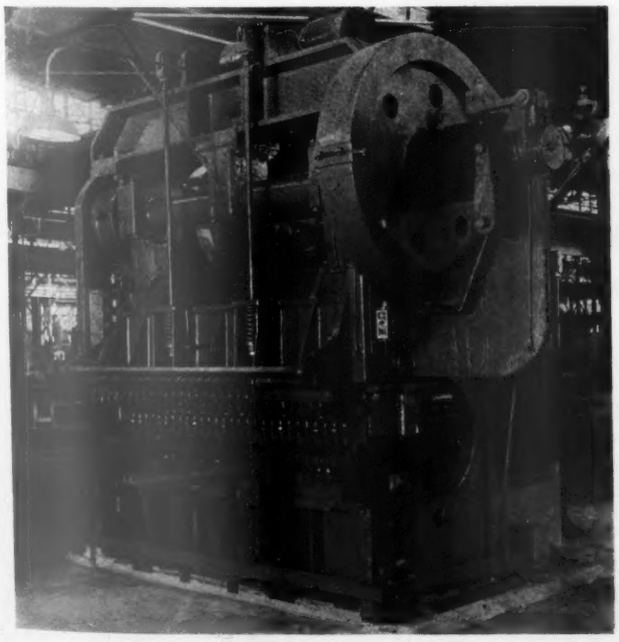
Arrangement of jig for babbitting crossheads and crosshead shoes

Two Machine Tools of Welded Construction

A LARGE multiple punch of all-welded steel-plate construction has been placed in operation in the shops of the Baldwin Locomotive Works, Eddystone, Pa., where it is being used for punching rivet holes in

Plate-bending roll unit of welded construction

aluminum sheets for locomotive caps which are being made for the Pennsylvania. This punch was built jointly by the Baldwin-Southwark Corporation, Eddystone, and Lukenweld, Inc., Coatesville, Pa. It can punch 40 holes at one stroke. Aside from a few small gray iron castings, it is entirely of rolled steel construction. The side frames are of 5-in. steel plate, burned to shape and welded. The bearing bosses were cut from heavy rounds and welded to the 5-in. side frames. They were then bored. The cross-bar which is designed to stiffen the back of the machine is a steel pipe with welded-on flanges and bolted to the side frames. Flat plate wings



Multiple punch of all-welded steel-plate construction

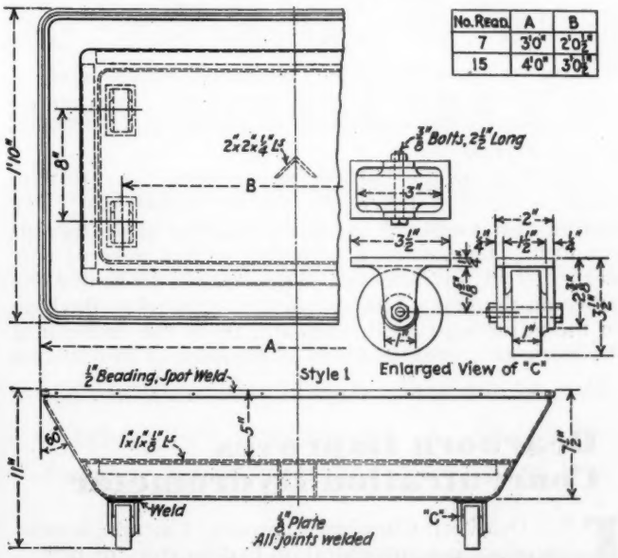
were welded on this pipe to form the motor base. This construction effected a marked saving in weight and in pattern cost. The weight, with punching attachments, is about 78,000 lb.

A unit of plate-bending rolls of welded construction and of unusually large capacity has also been installed in the plant of the Lukens Steel Company, Coatesville. It can bend cold plates up to 4 ft. wide and 3 in. thick and hot up to 4 ft. wide and 6 in. thick. The top roll has a diameter of 18 in. and the bottom roll 20 in. Plates travel through the rolls at a speed of 8 ft. per min.

This machine is also the joint product of the Baldwin-Southwark Corporation and Lukenweld, Inc., excepting for the rolls, which are steel forgings. The unit is of welded plate construction throughout, including the gears. The housings are of steel-plate welded construction, while the side rails are standard H- columns. The cross bracing for the gear case is comprised of two U-shaped plate channels welded across the bottom in the form of the letter X. The gears run in an oil bath. The oil is force-fed to the bearings and the gear tooth meshings, flowing back into a reservoir. The screwdown also runs in an oil bath. Two motors drive the machine, one the rolls and the other the screwdown. The complete unit weighs about 85,000 lb.

Oil and Chip Pan For Lathes

MANY railroad machine shops have lathes which are not provided with pans to catch oil and chips. Unless some means is provided for collecting the oil and chips as they fall from the work, the sur-



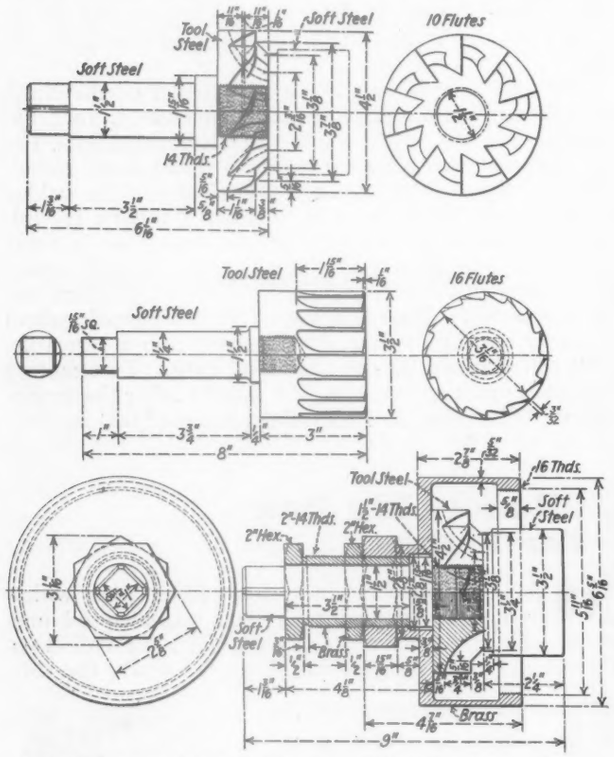
Pan used to catch oil and chips under lathes

rounding floor area and underneath the machine is constantly in a littered condition and unsafe for workmen.

The pan shown in the drawing is carried on four wheels so that it can be easily moved out from under the machine. The pan can be made to any length desired. This style of pan is built by one railroad in two lengths; 3 ft. and 4 ft. The pan is made of ⅛-in. sheet welded together. A ½-in. beading is spot welded around the top of the pan.

Repairing Consolidated Safety Valves

THE tools shown in the drawing are used for repairing the feather-valve seats and bases of 3½-in. Consolidated safety valves. Two cutting tools are provided. The 16-flute cutter, 3½ in. in diameter, is used to resurface the feather-valve surface in the base.



Tool for repairing 3½-in. Consolidated safety valves

It is made to the dimensions as shown and is turned with a wrench.

Referring to the half-section drawing, the 10-flute cutter is used to renew the feather valve seat. The bottom of the tool case is tapped 5 11/16 in. with 16 threads per inch. The cutter is provided with a nose of soft steel, 3½ in. in diameter, which serves to center the cutter on the seat. The tool case is screwed to the base on the adjusting-ring threads and feeds the cutter into the work as it is turned with a wrench.

Dearborn Improves Concentration Hydrometer

THE Dearborn Chemical Company, Chicago, is now introducing a concentration hydrometer for determining the total dissolved solids in boiler water, which has several distinctive points of difference and improvement over the instrument described on page 164 of the April *Railway Mechanical Engineer*.

This new instrument consists of but one float and one tube, all scales being enclosed in the float, a feature covered by patent application. The hydrometer is quick acting because a mercury thermometer is used, the space between the tube and the float permitting the latter to rise more rapidly. The float is provided with substantial projecting knobs to prevent friction of the float against the tube.

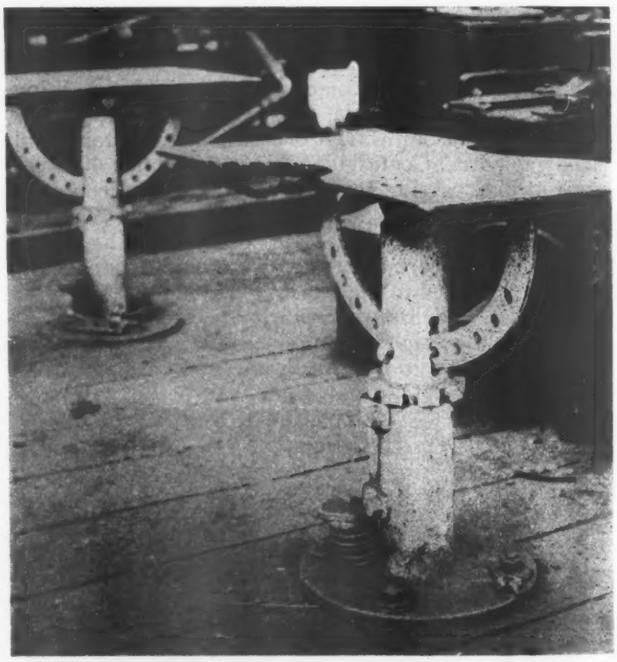
This novel method of construction has a number of advantages, including compactness, absence of special care required in operation and ability to stand rough handling because of the single tube design. Any danger of float stem breakage is said to be eliminated. The operation is designed to be simple so that readings can be taken in the cab of a moving locomotive.

The instrument may be easily taken apart for cleaning, and the rubber bulb need never be removed, the float being withdrawn from the jar or tube by removing the lower rubber fitting. The outer rim of this fitting is hexagonal in shape, which prevents the instrument from rolling when at rest. The float can be removed from the assembled instrument and operated in a separate container if desired.

Adjustable Stand for Air Compressors

WHEN cross-compound air pumps are being repaired it is desirable to shift their position at times to facilitate the repairs. The illustration shows an adjustable bench which has been devised for this purpose. This bench stands 36 in. from the floor.

The base is made of cast iron and is in two sections. The upper section has a wrought-iron bar inserted which



The table of this compressor repair stand may be revolved or tilted in any direction

projects into the base, insuring rigidity and safety. A slot is provided through the upper section of the stand through which a half circle is inserted and connected on both ends to the table plate. This is made from bar iron ¾ in. by 3½ in. Twelve ⅝-in. holes are drilled through it and a steel pin extending through the stand permits the table to be adjusted to the desired position.

The table plate is made from ½-in. plate so constructed as to permit the air compressor to have a level bearing on it. A casting, riveted directly in the center of the table plate is hinged to the stand with a 1¾-in. steel pin.

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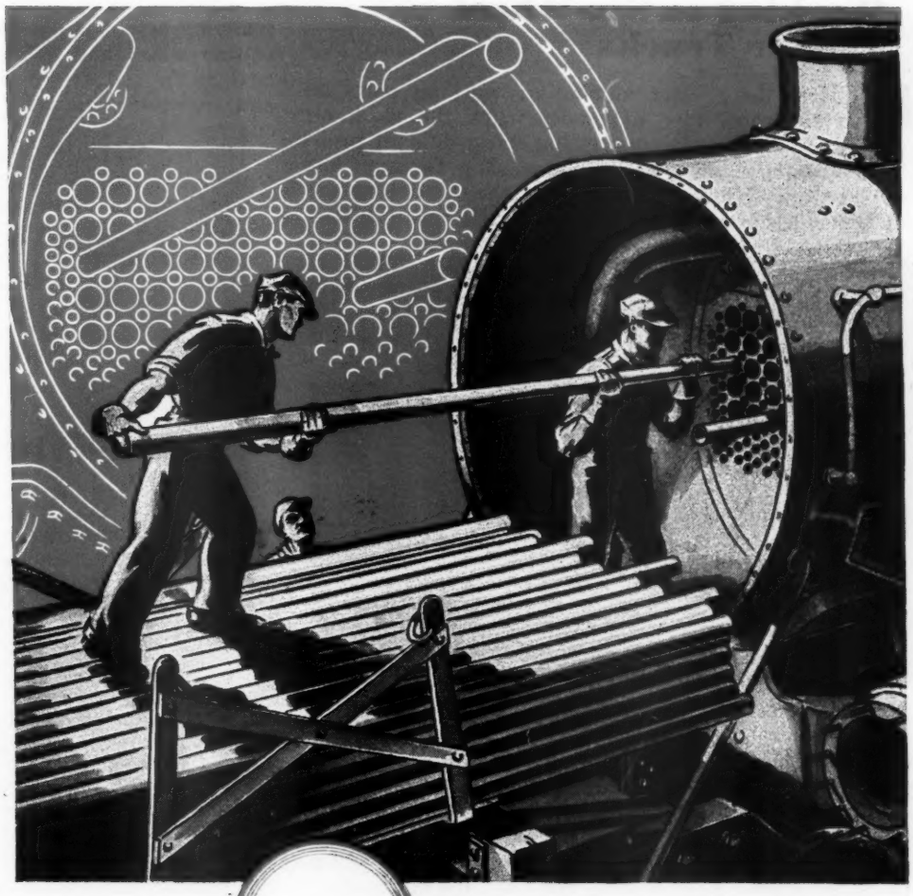


TONCAN
REDUCES TUBE TROUBLES

Water difficulties are becoming progressively severe for many roads. « Even after treatment to prevent scale formation, boiler tube pitting is prevalent. « Many large roads are combating tube troubles by using Toncan Iron. « Toncan Iron tubes have the natural corrosion resistance of iron fortified by the addition of copper and molybdenum. « Toncan Iron tubes not only will resist corrosion and pitting but they can be cold-worked without danger of subsequent fire-cracking. « Toncan Iron tubes are a contribution of modern metallurgy to the reduction of locomotive maintenance.

Toncan Iron Boiler Tubes, Pipe, Plates, Culverts, Rivets, Staybolts, Tender Plates and Firebox Sheets • Sheets and Strip for special railroad purposes • Agathon Alloy Steels for Locomotive Parts Agathon Engine Bolt Steel • Nitralloy • Agathon Iron for pins and bushings Agathon Staybolt Iron • Climax Steel Staybolts • Upson Bolts and Nuts • Track Material, Maney Guard Rail Assemblies • Enduro Stainless Steel for dining car equipment, for refrigeration cars and for firebox sheets • Agathon Nickel Forging Steel (20-27 Carbon)

TONCAN COPPER Molybdenum IRON

The Birdsboro Steel Foundry & Machine Company of Birdsboro, Penna., has manufactured and is prepared to supply under license, Toncan Copper Molybdenum Iron castings for locomotives.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES: YOUNGSTOWN, OHIO

Working on Six-Wheel Tender Trucks

DUE to the greater number of working parts on a six-wheel type of tender truck the work on such a truck presents a somewhat more difficult problem than on the older trucks. One shop foreman has simplified his problem by turning the trucks upside down when they are placed on the truck repair tracks

Turning them upside down simplifies the repair job

which permits free access to most of the parts and facilitates the removal of wheels and journal boxes by the use of an overhead crane.

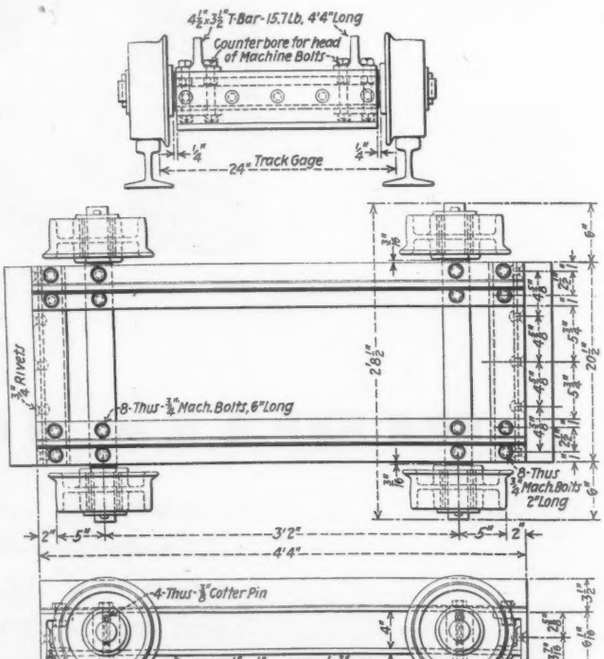
In this shop the machine foreman maintains a complete set of reconditioned brake rigging parts in which the hangers have been bushed and the pins and cotters renewed so that application may be made to the truck as soon as the worn parts have been stripped.

Hennessy Lubricator For Trailer Journals

THE Hennessy Lubricator Company, 75 West street, New York, has developed and placed on the market an improved mechanical lubricator for locomotive trailing-truck journals having outside bearings. This new development, which has covered a period of nearly two years, follows the original design described in the October, 1930, issue of the *Railway Mechanical Engineer*, page 591. The outside-bearing trailing-truck journal lubricator requires no waste. Loss of oil is negligible, if the cellar is not filled above the point indicated "Oil Level" on the drawing. The elimination of the waste and the improvement in the oil reservoir, which has been designed to prevent loss of oil, are improvements over previous designs.

Referring to the section drawing, the felt pad *C* is used as the medium for distributing the oil over the journal. The oil is pumped to the felt pad by the pump *D* which is placed along the bottom of the cellar. The pumping action is obtained from the lateral movement of the wheel and axles. The lever *A*, which is set against the end of the axle, operates the pump plunger and spring *B* which forces the oil up to the delivery cup *E*.

The felt pad, which is contained in the pan *G*, is soaked in warm oil for not less than one hour previous to application. This is done by placing the lubricator with the pan and felt pad attached in an oil vat. The felt pad can be easily removed from the pan if desired, by spreading the center pieces of the pan sufficiently apart to clear the delivery cup. The sheet metal pieces *X* are made to extend the full length of the journal and down into the cellar as shown.


4½"x3½" T-Bar-15.7 Lb. 4'4" Long
Counterbore for head of Machine Bolts
24" Track Gage
8-Thus-¾" Mach. Bolts, 6" Long
8-Thus ¾" Mach. Bolts 2" Long
4-Thus-⅞" Cotter Pin
2-Thus ½"x4½" W.I. Bars, 4'2⅞" Long
2-Thus 2½"x2½"x½" Lf. 20½" Long
6" Z-Bar-25.4 Lb. 20½" Long, 2 Req.

Shop truck for transporting driving wheels

Driving-Wheel Truck

THE driving-wheel truck shown in the two drawings is standard on an eastern road. It is designed for operation over a 24-in. gage shop track. With the exception of the four cast-iron wheels, all of the parts are made and assembled in the shop. The truck body is 4 ft. 9⅞ in. long. Six-inch Z-bars, 20½ in. long, are

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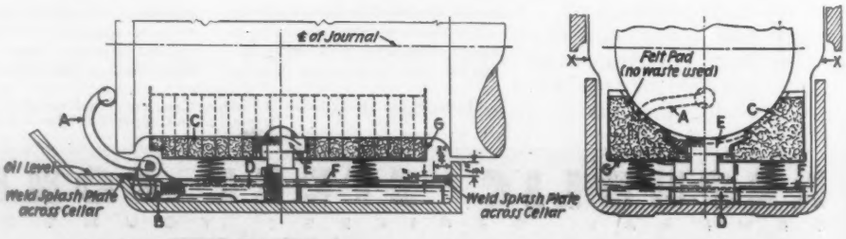


Section drawing of the Hennessy outside-bearing trailing-truck journal lubricator

THUMBS DOWN

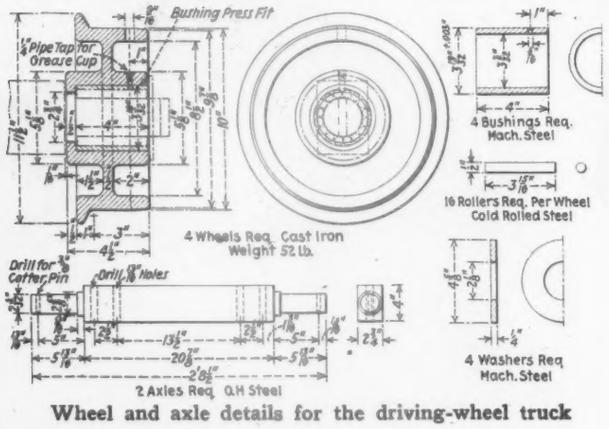
On the obsolete locomotive

WHEN you put new, modern locomotives in service a few years ago you saved money. « If you now return to service the old, obsolete locomotives that they displaced you will lose money. « Present operating costs are based on the use of your best power. « Have you enough of the new locomotives to handle increasing traffic at the same low cost?

LIMA LOCOMOTIVE WORKS INCORPORATED

LIMA LOCOMOTIVE WORKS • Incorporated • LIMA • OHIO

secured to both ends of the truck. The driving wheels are carried on the lower horizontal legs of the Z-bars which are placed close to the floor, so that the wheels can be rolled off or onto the truck without the assistance of a crane. The axles are made of OH steel. The


Bushing Press Fit
Pipe Tap for Grease Cup
4 Bushings Req. Mach. Steel
16 Rollers Req. Per Wheel Cold Rolled Steel
4 Wheels Req. Cast Iron Weight 52 Lb.
Drill for Cotter Pin
Drill 5/8" Holes
4 Washers Req. Mach. Steel
2 Axles Req. O.H. Steel

Wheel and axle details for the driving-wheel truck

body chassis is braced with ½-in. by 4½-in. wrought iron bars. Two 4½-in. by 3½-in. T-bars, 4 ft. 4 in. long, are bolted to the top of the chassis, with ¾-in. machine bolts.

Electric-Arc Cutting Wheel

A UNIQUE method for cutting various metal sections has been devised by the Electric Arc Cutting & Welding Company, Newark, N. J. A belt-driven wheel forms one electrode and the metal to be cut, the other. Several hundred amperes at a low voltage pass between the cutting wheel and the work, the wheel revolving and constantly presenting a new and cool surface.

The wheel in operation before the arc is struck

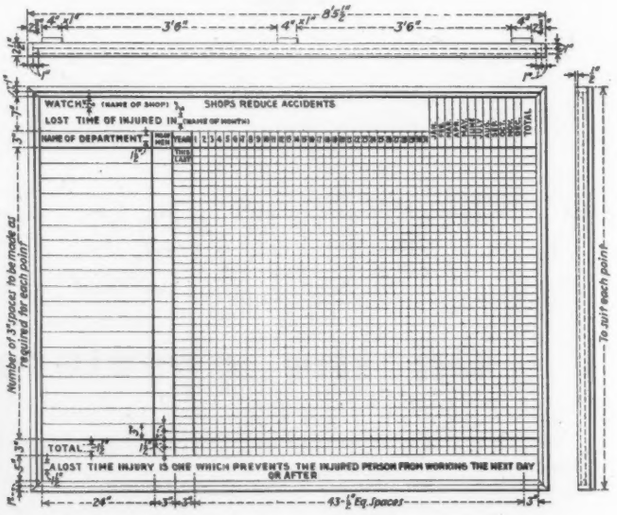
Either alternating or direct current may be used, but a.c. is recommended as it is usually easier to get the required large current and low voltage from such a source. For mild steel and most other work, the cutting wheel consists of a ten-gage mild steel circle operating at a speed of 1,800 r.p.m. or more. The wheel does not wear out but gradually becomes larger and occasionally has to be shaved off to its original dimension. Special glass in a bracket-mounted frame protects the operator from the glare of the arc and from flying sparks.

For cutting certain types of alloys, carbon, carborundum, alundum and other special cutting wheels are provided.

Standard Accident Ledger Board

THE accident ledger board shown in the drawing is the standard method of bulletining and recording accidents in the shops of a large eastern railroad. It is made of seasoned poplar 8 ft. 5½ in. long and with a height to suit each point where the board is installed. The board is painted dull black with the lines and lettering in white.

Spaces are provided for the name of the shop, for


WATCH (NAME OF SHOP)
SHOPS REDUCE ACCIDENTS
LOST TIME OF INJURED IN (NAME OF MONTH)
NAME OF DEPARTMENT
TOTAL
TOTAL
A LOST TIME INJURY IS ONE WHICH PREVENTS THE INJURED PERSON FROM WORKING THE NEXT DAY OR AFTER
Number of 3" spaces to be made as required for each point
To suit each point

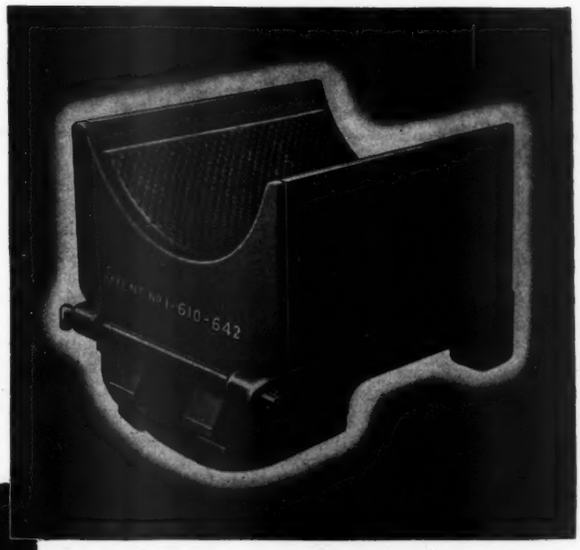
Ledger board which shows the lost-time accidents up to date and compares with past performance

the month showing the last report of lost time of injured, name of each department and the number of men employed in each department. Each department has two lines on which are recorded the daily injuries for the present year and for the same day the year previous. These figures are totaled for the month and year.

A lost-time injury is one which prevents the injured person from working the next day or thereafter.

(Turn to next left-hand page)

WHERE HONOR IS DUE.—Quite appropriate was the recent action of Mrs. J. F. Dreidger, of Craik, Sask.. When she became the mother of a son while traveling on a Canadian National train from her home in Regina, Sask., she named the youngster "Cameron Norman Robert," to match the initials of the railway.



LOCOMOTIVE LUBRICATION Again Improved

In the improved Franklin Driving Box Lubricator and Spreader, another advance has been taken in the lubrication of the big engine.

Now the whole lubricator can be removed, re-packed and replaced as a unit with the follower spring held from interfering with the re-application of the packed cellar. The follower plate can be removed and cleaned without disturbing the spreader.

A cast steel spreader prevents the driving box jaws from closing in and gripping the cellar. The spreader also protects the cellar when the locomotive is being lifted.

All perforated and follower plates for a given size of journal are interchangeable, regardless of design of box. This reduces errors and the number of plates that must be stocked.

On modern locomotives, use a modern driving box lubricator. Because it avoids hot boxes and reduces the stock of replacement parts and maintenance, apply the improved Franklin Driving Box Lubricator and Spreader as locomotives are shopped. And use only Franklin parts for repairs and save labor. After all, the labor cost is the big expense item.

THE FRANKLIN SLEEVE JOINT

Close coupling reduces overhang and wear and overcomes the tendency for connection to unscrew

FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK CHICAGO MONTREAL

Among the Clubs and Associations

MECHANICAL DIVISION, A.R.A.—H. A. Wheeler, president of the Railway Business Association, will address the opening session of the Mechanical Division meeting at Chicago, June 23. In addition to Mr. Wheeler's address, there will be addresses by M. J. Gormley, executive vice-president, American Railway Association, and Silas Zwight, chairman of the Mechanical Division. ¶The program calls for a two-day meeting, on the first day of which the reports of the following committees will be discussed: Nominations; Safety Appliances; Joint Committee on Automatic Train Line Connectors; Locomotive and Car Lighting; Automotive Rolling Stock; Joint Committee on Utilization of Locomotives and Conservation of Fuel; Electric Rolling Stock; Specifications for Materials, and Locomotive Construction. ¶On the second day, following an address by the Hon. Frank McManamy, member of the Interstate Commerce Commission, the following committee reports will be presented for discussion: Arbitration; Prices for Labor and Materials; Tank Cars; Loading Rules; Wheels; Brakes and Brake Equipment; Couplers and Draft Gears, and Car Construction. ¶An appendix to the report of the Committee on Car Construction, covering the proposed design of a steel-sheathed, wood-lined box car for generally unrestricted interchange service, will be distributed at the meeting for consideration following the discussion of the report of the committee. ¶Should it be impossible to complete the business of the meeting in two days, it will continue into Saturday, June 25.

WESTERN RAILWAY CLUB.—The annual dinner and regular monthly meeting of the club was held Monday evening, May 23 at the Hotel Sherman, Chicago, being featured by a discussion of Russian railroad and industrial conditions by C. A. Gill, superintendent of motive power, Baltimore & Ohio, Baltimore, Md. Mr. Gill's remarks were made under the general subject "The Russian Situation as Observed by an American Railroad Man", being illustrated by lantern slides. ¶A brief business meeting was held just preceding Mr. Gill's address, at which the following officers were elected for the ensuing year: President, O. E. Ward, superintendent of motive power, Chicago, Burlington & Quincy, Chicago; first vice-president, J. E. Bjorkholm, assistant superintendent of motive power, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis.; second vice-president, C. J. Wymer, superintendent of the car department, Chicago & Eastern Illinois, Danville, Ill.; treasurer, J. W. Fogg, MacLean-Fogg Lock Nut Company, Chicago; secretary, J. H. Nash, Dri-Steam Valve Company, Chicago; directors: W. A. Bender, master car builder, Chicago & Alton, Bloomington, Ill.; B. J. Farr, general superintendent of motive power and car equipment, Grand Trunk Western, Battle Creek, Mich.; J. T. Gillick, vice-president, Chicago, Milwaukee, St. Paul & Pacific, Chicago; F. R. Mays, general superintendent of motive power, Illinois Central, Chicago; F. F. McCarthy, master mechanic, New York Central, Collinwood, Ohio; J. H. Nash, Dri-Steam Valve Company, Chicago; J. H. Reisse, mechanical assistant to vice-president, Chicago, Burlington & Quincy, Chicago; L. A. Richardson, general superintendent of motive power, Chicago, Rock Island & Pacific, Chicago; C. T. Ripley, chief mechanical engineer, Atchison, Topeka & Santa Fe, Chicago; G. F. Slaughter, American Steel Foundries, Chicago; J. C. Shreeve, superintendent of motive power, Elgin, Joliet & Eastern, Joliet, Ill.; A. W. Turner, assistant division master mechanic, Michigan Central, Niles, Mich. The officers were elected by unanimous vote cast by the secretary.

Directory

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION.—T. L. Burton, Room 5605 Grand Central Terminal building, New York.

ALLIED RAILWAY SUPPLY ASSOCIATION.—F. W. Venton, Crane Company, Chicago.

AMERICAN RAILWAY ASSOCIATION.—DIVISION V.—MECHANICAL.—V. K. Hawthorne, 59 East Van Buren street, Chicago. Meeting June 23-24, Congress Hotel, Chicago.

DIVISION V.—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey street, New York. Meeting June 22-23, Hotel Stevens, Chicago.

DIVISION I. — SAFETY SECTION. — J. C. Caviston, 30 Vesey street, New York.

DIVISION VIII.—CAR SERVICE DIVISION.—C. A. Buch, Seventeenth and H. streets, Washington, D. C.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet avenue, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth street, New York.

RAILROAD DIVISION.—Marion B. Richardson, associate editor, *Railway Mechanical Engineer*, 30 Church Street.

MACHINE SHOP PRACTICE DIVISION. — Carlos de Zafra, care of A. S. M. E., 29 West Thirty-ninth street, New York.

MATERIALS HANDLING DIVISION.—M. W. Potts, Alvey-Ferguson Company, 1440 Broadway, New York.

OIL AND GAS POWER DIVISION.—L. H. Morrison, associate editor, Power, 475 Tenth avenue, New York.

FUELS DIVISION.—A. D. Black, associate editor, Power, 475 Tenth avenue, New York.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 7016 Euclid avenue, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce street, Philadelphia, Pa. Annual meeting June 20-24, Haddon Hall, Atlantic City, N. J.

AMERICAN WELDING SOCIETY.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

CAR DEPARTMENT OFFICERS ASSOCIATION.—A. S. Sternberg, master car builder, Belt Railway of Chicago.

CAR FOREMEN'S ASSOCIATION OF OMAHA, Council Bluffs and South Omaha Interchange.—Geo. Kriegler, car foreman, Chicago, Burlington & Quincy, Sixteenth avenue and Sixth streets, Council Bluffs, Iowa. Regular meetings, second Thursday of each month at Council Bluffs.

CINCINNATI RAILWAY CLUB.—D. R. Boyd, 2920 Utopia Place, Hyde Park, Cincinnati, Regular meeting, second Tuesday, February, May, September and November.

CLEVELAND RAILWAY CLUB.—F. B. Frericks, 14416 Alder avenue, Cleveland, Ohio. Meeting second Monday each month, except June, July and August, at the Auditorium, Brotherhood of Railroad Trainmen's building, West Ninth and Superior avenue, Cleveland.

INDIANAPOLIS CAR INSPECTION ASSOCIATION.—P. M. Pursian, 823 Big Four building, Indianapolis, Ind. Regular meetings first Monday of each month at Hotel Severin, Indianapolis, at 7 p.m. Noon-day luncheon 12:15 p.m. for Executive Committee and men interested in the car department.

INTERNATIONAL RAILROAD MASTER BLACKSMITH'S ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—C. T. Winkless, Room 707, LaSalle Street Station, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash street, Winona, Minn.

MASTER BOILERMAKERS' ASSOCIATION. — A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

MASTER CAR BUILDERS' AND SUPERVISORS' ASSOCIATION.—See Car Department Officers Association.

NATIONAL SAFETY COUNCIL—STEAM RAILROAD SECTION.—W. A. Booth, Canadian National, Montreal, Que.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meeting second Tuesday in each month, excepting June, July, August and September. Copley-Plaza Hotel, Boston.

NEW YORK RAILROAD CLUB.—A. N. Dugan, National Bearing Metals Corporation, 230 Park avenue, New York. Meetings third Friday in each month, except, June, July and August, at 29 West Thirty-ninth street, New York. Annual outing at Westchester Country Club, Rye, N. Y., June 29, 1932.

PACIFIC RAILWAY CLUB.—W. S. Wollner, P. O. Box 3275, San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.

RAILWAY BUSINESS ASSOCIATION. — Frank W. Noxon, 1124 Woodward building, Washington, D. C.

RAILWAY CAR MEN'S CLUB OF PEORIA AND PEKIN.—C. L. Roberts, R. F. D. 5, Peoria, Ill.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August, Ft. Pitt Hotel, Pittsburgh, Pa.

RAILWAY FIRE PROTECTION ASSOCIATION.—R. R. Hackett. Baltimore & Ohio, Baltimore, Md.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, American Railway Association.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, July, September and November. Annual meeting third Thursday in November. Ansley Hotel, Atlanta, Ga.

SUPPLY MEN'S ASSOCIATION.—E. H. Hancock, treasurer, Louisville Varnish Company, Louisville, Ky. Meets with Equipment Painting Section, Mechanical Division American Railway Association.

TRAVELING ENGINEERS' ASSOCIATION. — W. O. Thompson, 1177 East Ninety-eight street, Cleveland, Ohio.

WESTERN RAILWAY CLUB.—J. H. Nash, 343 South Dearborn street, Chicago. Regular meetings, third Monday in each month.

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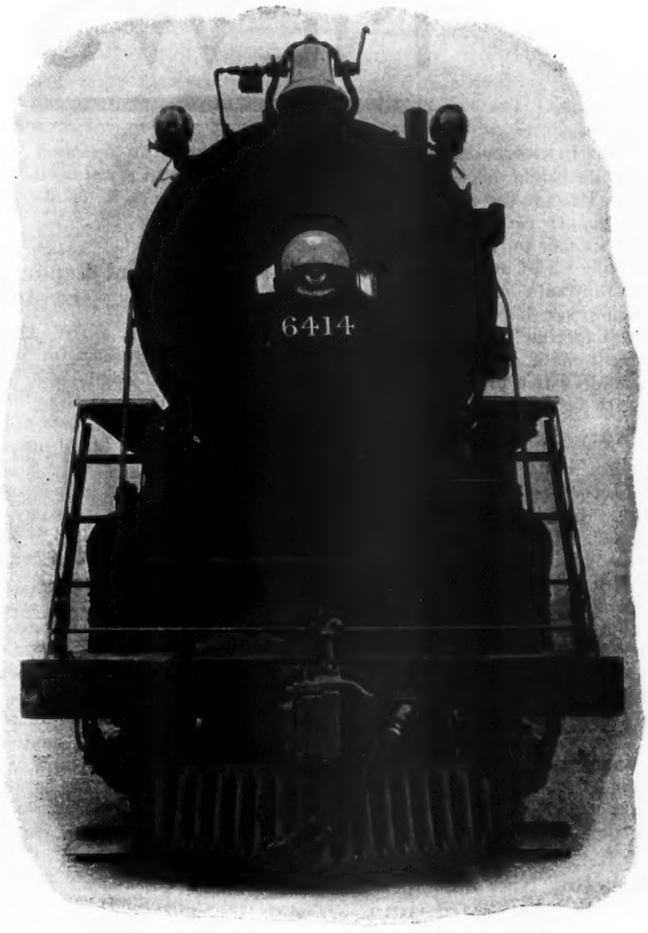
Scrap the old Power and BOOST NET EARNINGS



TODAY large numbers of locomotives, practically all of them more or less antiquated, are stored on side tracks. Why?

Because traffic volume is reduced and the railroads realize the economy of handling tonnage with up-to-date power.

Why not avoid the necessity of putting the old locomotives back into service when business picks up? Instead of spending money on maintenance, spend it on new power, which will render improved service and boost net earnings.

It takes Modern Locomotives to make money these days!

THE BALDWIN LOCOMOTIVE WORKS

PHILADELPHIA

NEWS

THE PENNSYLVANIA has placed orders with its Enola steel car shops at Harrisburg, Pa., for the remodeling of 25 standard hopper cars of 50 tons' capacity for the special purpose of hauling cement in bulk. The new parts will be made at the railroad's Altoona works. Last December six hopper cars were converted for experimental purposes. This bulk cement car is a covered hopper car which is made water proof.

Katy Makes Hot Box Record

OVER 300,000 CAR-MILES per hot box is the record set up by the Missouri-Kansas-Texas in 1931, as the result of care exercised in inspecting and packing journal boxes on freight cars, according to the M-K-T Employees' magazine for April. The average car-miles per freight car set out because of hot boxes was 424,382, as compared with 203,969 in 1930. The total number of hot journals developed in 1931 was 672, as compared with 1,702 in 1930.

The improvement was brought about by continued co-operation between mechanical and operating employees and by a carefully planned policy of strict inspection and workmanship.

Micheline Rail Car Speeds Service on French Run

THE INITIAL SERVICE of a Micheline rail car, now in regularly scheduled operation between Meziers and Givet, France, has effected time savings of 41 min. over the previous steam train schedule, according to a recent statement of the Edward G. Budd Manufacturing Company, Philadelphia, Pa.

"The Micheline, pneumatic-tired rail car, has been placed in regular operation between these two French cities, a distance of forty miles," the statement said. "Previously the steam train left Meziers at 8:50 and arrived at Givet at 10.28. The Micheline now leaves at the same hour, but arrives at Givet at 9:47."

Mechanical Division Scholarship Available

A SCHOLARSHIP at Stevens Institute of Technology will be available to sons of members of the Mechanical Division, American Railway Association, when the division scholarship at that institution becomes vacant in September, 1932. The scholarship embraces a course which leads to the degree of mechanical engineer and which includes instruction in electrical, civil and other branches of engineering.

Applications for the scholarship will be received until August 15, 1932. The scholarship will be awarded by the president of the college on the recommendation of the association. Should there be no applications from the son of either a living or deceased member of the mechanical division, the scholarship will then be available to the son of any railroad employee.

Annual Report of Bureau of Explosives

COLONEL B. W. DUNN, chief inspector of the Bureau for the Safe Transportation of Explosives, etc., has issued his annual report for the year 1931. Considering explosives only, the report shows no persons killed, none injured and property loss of only $113. Amplifying the statement to include other dangerous articles—acids, corrosive liquids, gasoline, etc., there was a total of 776 accidents during the year, but there were no persons killed and only 20 injured; property loss $300,-271.

The usual elaborate tables are given showing losses, casualties and classification of causes, for 13 years.

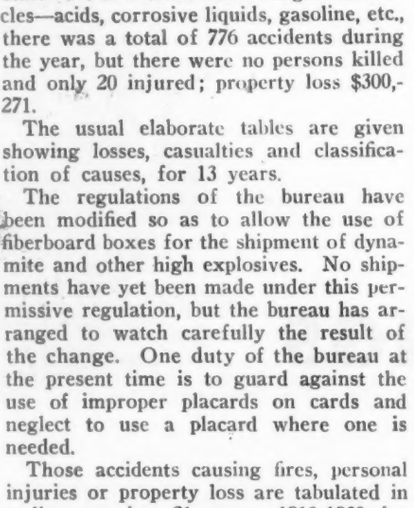
The regulations of the bureau have been modified so as to allow the use of fiberboard boxes for the shipment of dynamite and other high explosives. No shipments have yet been made under this permissive regulation, but the bureau has arranged to watch carefully the result of the change. One duty of the bureau at the present time is to guard against the use of improper placards on cards and neglect to use a placard where one is needed.

Those accidents causing fires, personal injuries or property loss are tabulated in a list covering 21 years, 1910-1930 inclusive, supplemented by a similar statement for 1931. No less than 199 different articles appear in this table, and 78 of them figured in the records of 1931. The more important items (in the order of the number of cases) are gasoline, sulphuric acid, hydrochloric acid, batteries, alcohol, matches, nitric acid and crude petroleum. Twelve fires occurring in the transportation of gasoline, 15 with charcoal and 33 with matches, are set forth in more detailed lists.

The report contains all of the illustrated educational bulletins which have been issued during the year; these fill 30 pages.

The membership of the bureau includes 405 companies, operating 307,757 miles of railroads, and numerous manufacturers figure as associate members. The bureau now has 30 inspectors and the personnel of the chemical laboratory numbers four. Freight station inspections totaled 7,379; lectures to railroad employees 365; and 472 cars of explosives in transit were inspected. Of those cars, 10 showed serious violations of regulations.

* * *



A first-class compartment on the Swiss Federal Railroads

Precooling Programs Under Way On Two Railroads

THE PENNSYLVANIA announces that plans for the coming summer call for the precooling, when necessary, of all sleeping cars operated on the system, not only those making long trips, but also those which make single night runs between the smaller cities. Extensive refrigerating apparatus is now being installed at all of the principal terminals and it is expected that the temperature of all sleeping cars can be reduced at least 10 deg.

The company's plans for the installation of continuous cooling and air conditioning in dining cars this summer include 38 diners, on most of which the equipment is practically finished. This will provide air-conditioned diners on all of the principal limited trains and also on the hourly trains between New York and Philadelphia, and between New York and Washington.

The dining cars will be equipped with an ice-water cooling system which was first tested last summer. From ice containers carried under the car, ice water is pumped through radiator coils located in each end of the car where blowers force purified air over the cold radiators into the dining room. The process not only cools the air, but also lowers the humidity and adds approximately 25 per cent of filtered fresh air to the constant circulation of the cooled and purified air. Temperature regulation within the cars will be governed by the outside temperature and maintained at a degree which will guard against sudden changes for passengers entering or leaving the cars.

The Pennsylvania is also testing several mechanical refrigerating systems. The ice-water systems have been so installed that they can be converted if desired into mechanical units when the service trials are completed.

THE NEW YORK CENTRAL plans to precool passenger cars on all its principal

trains and to install continuous cooling and air-conditioning equipment in dining cars operated on its leading trains. The new precooling system, to be inauguarted as fast as machines are delivered, are expected to be completely in effect within six weeks while the first air-conditioned dining cars are expected to be ready by June 28 and the balance about ten days later.

The innovation will be instituted first on the Twentieth Century Limited. The precooling system, which will be used to reduce the temperature at least 10 deg. below the prevailing outside temperature in the road's parlor cars, sleepers and club cars and in some cases in its coaches, will be installed at not only Grand Central terminal, New York, but also in the La Salle street and Michigan Central stations at Chicago and at the New York Central terminals in Buffalo, Detroit, Cleveland, Cincinnati, Indianapolis, St. Louis and Boston.

Consider Scrap Proposals

THE COMMITTEE on Scrap Iron of the American Railway Association has accepted recommendations proposed by the Institute of Scrap Iron and Steel to change certain terms of award and sale of railroad scrap and at the next annual convention will recommend their incorporation in the scrap contracts of the individual railroads.

Some of the proposals accepted by the A.R.A. committee require shipments to be made within 30 days after the receipt of shipping instructions which shall be issued within 10 days after notice of the award has been received. Claims for apparent shortages of 1,000 lb. or over will be considered, provided the necessary documents are presented within 30 days. Net ton basis shall be uniform for all railroad scrap lists. Where more than one car is offered for sale, the offer shall be in tonnages instead of in cars. All cars shall be light-weighed, uncoupled. Awards shall be made within 48 hours after the time set for closing the bids and, wherever possible, all scrap shall be loaded to minimum carload switching weights. Several changes proposed in the A.R.A. scrap classification were also accepted.

The Pennsylvania has announced that it will immediately put into effect one of the proposed changes, without waiting for the action of the A.R.A. convention. Heretofore, the Pennsylvania stipulated that claims for shortages must total $10 or more before they would be investigated, but beginning with the April list any claims for shortages of 1,000 lb. and over will be investigated.

Supply Trade Notes

GEORGE E. COFFEY, sales representative of the Union Railway Equipment Company, Chicago, has resigned.

THE HENNESSY LUBRICATOR COMPANY has moved its office from 136 Liberty street to 75 West street, New York City.

THE BIRD-ARCHER COMPANY has moved its offices from 1 East Forty-second street to 90 West street, New York.

THE MACLEAN-FOGG LOCK NUT COMPANY Chicago, has opened an office in the Paul Brown building, St. Louis, Mo., under the management of A. W. MacLean.

R. E. ZIMMERMAN has been appointed assistant to the president of the United States Steel Corporation with headquarters at New York.

THE ENTERPRISE RAILWAY EQUIPMENT COMPANY offices are now located in the Buckingham building, 59 East Van Buren street, Chicago.

F. S. WILCOXEN, vice-president of the Standard Locomotive Equipment Company, has moved his headquarters from 1316 McCormick building, Chicago, to 1819 Clinton street, Toledo, Ohio.

THE GOODYEAR TIRE & RUBBER COMPANY, Akron, Ohio, has received the first license to manufacture rubber tires for operation on railroad cars in the United States under Michelin French patents, according to an announcement made by President P. W. Litchfield.

THE POOLE FOUNDRY & MACHINE COMPANY, conducting the former business of the Poole Engineering & Machine Company, has been organized with general offices and works at Woodberry, Baltimore, Md. S. P. Brady is president; S. P. Brady, Jr., vice-president, and L. M. Ricketts, secretary and treasurer.

E. K. CONNEELY, vice-president of the Standard Steel Corporation, with headquarters at Pittsburgh, Pa., has been placed in charge of western district sales, with headquarters at Chicago. J. C. Snyder, manager of sales of the central district of the Standard Steel Car Company and vice-president of the Richmond Car Company, has been elected a vice-president of Standard and of the Osgood Bradley Car Corporation and has assumed charge of the Pittsburgh office and of sales in the central district.

THE FARVAL CORPORATION 3277 East Eightieth street, Cleveland, Ohio, has acquired the manufacturing and sales rights of the Farval centralized system of lubrication formerly manufactured by Lubrication Devices, Inc., Battle Creek, Mich.

A. CLARK MOORE, executive vice-president of the Chicago Railway Equipment Company, has been elected president to succeed E. B. Leigh, deceased. W. S. Oppenheim, a director of the company, has been elected vice-president, and G. N. Van Sweringen, assistant to the vice-president, has been appointed assistant to president.

JOHN H. LOCKE has been elected a vice-president of the General Steel Castings Corporation, Eddystone, Pa. Mr. Locke was born on October 19, 1888, at Cambridge, Mass. He was graduated in 1908 from Massachusetts Institute of Technology where he specialized in electrochemistry, later doing graduate work at Harvard University. In 1910 he joined the Westinghouse Lamp Company, first doing research work and later engaged in both research and production

John H. Locke

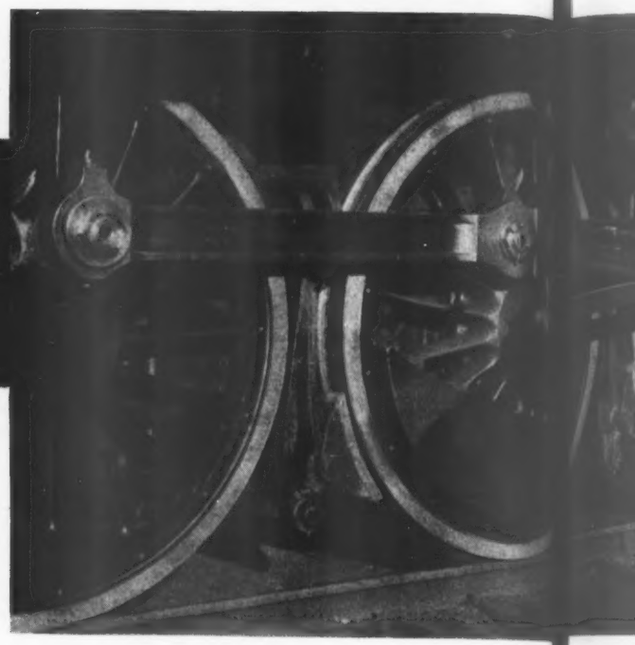
work. He subsequently served with a lamp company at St. Louis, where he was engaged in the manufacture of electric lighting equipment. In June, 1912, he went to the Commonwealth Steel Company, serving for about a year as a construction draftsman in the engineering department, after which for several years he was engaged in research work. In 1917, he was appointed assistant to the general manager of the Commonwealth Steel Company and in August, 1929, assistant general manager of the Commonwealth division of the General Steel Castings Corporation with headquarters at Granite City, Ill. He was appointed general manager of the same division in June, 1931, and the following August was appointed manager of operations of all plants of the corporation, with headquarters at Eddystone, which position he held at the time of his recent election as vice-president.

(Turn to second left-hand page)

Domestic Orders Reported During May, 1932

Name of Company	Freight Cars No. Ordered	Type	Builder
Hill & Suender, Inc.	9	Air-dump	Koppel Industrial Car & Equipment
General Chemical Company	2	Tank	American Car & Foundry Company
Union Tank Car Company	5	Tank	Graver Tank & Manufacturing Corp.
Alaska Railroad	10	Hopper	General American Car Company
Total for month	26		

QUALITY
All Ways



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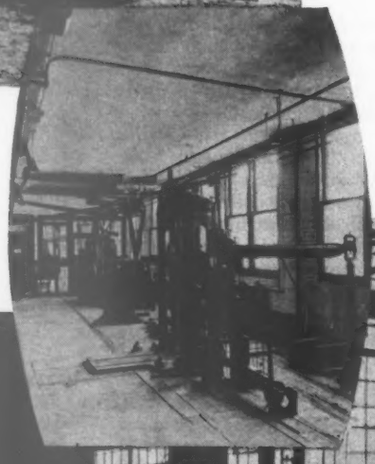

QUALITY
Always

CO FORGINGS

INSURE MAXIMUM TON-MILES FOR THE FEWEST MAINTENANCE DOLLARS—

THAT means economy. Their great strength and durability give maximum insurance against the engine failures which jeopardize earning power and pile up maintenance expense —that means more economy plus safety.

Dependable locomotive performance is so important that there should be no compromise with quality in locomotive forgings. And there are no short cuts to high quality.

The manufacture of quality forgings involves a series of necessary scientific operations. Each must be carefully executed under technical control and properly correlated for best results.

ALCO quality forgings are made from billets which must pass rigid tests for chemical properties and physical soundness. High carbon steels are subjected to a tensile test and alloy steels to a full section macroscopic test. The billets are properly preheated before forging, using indicating and recording pyrometers to eliminate guesswork and the human element. The forgings are formed on presses and hammers of sufficient capacity to insure proper penetration well into the mass. The forgings are then heat-treated, again under pyrometer control, to insure the best in grain refinement and the highest ductility with the desired tensile strength.

Experience proves that these forgings stand up under the severe stresses of hard service.

American Locomotive Company
30 Church Street New York N.Y.

W. H. STEWART has been elected president of the Pacific Coast Steel Corporation, with headquarters at San Francisco, Cal. The Pacific Coast Steel Corporation is a Bethlehem Steel Corporation subsidiary. Mr. Stewart, since 1923, has been vice-president of Bethlehem Steel Export Corporation, New York, in charge of Bethlehem's foreign business. He succeeds to the position formerly held by D. E. McLaughlin, who retired some months ago. S. M. Bash has been elected vice-president of Bethlehem Steel Export Corporation; he formerly held the office of assistant to the vice-president.

J. FREDERIC BYERS, vice-president of A. M. Byers Company, Pittsburgh, Pa., has been elected chairman of the board, succeeding his brother, the late E. M. Byers, and George A. Blackmore, vice-

J. Frederic Byers

president, general manager and a director of the Westinghouse Air Brake Company and president and general manager of the Union Switch & Signal Company, has been elected also a director of the A. M. Byers Company. J. Frederic Byers, a son of the founder of the company, was graduated from Yale University in 1904 and since that time has been continuously identified with the company, serving since 1905 as vice-president. He is also a director of the Westinghouse Air Brake Company, the Union Switch & Signal Company and a number of banking organizations of Pittsburgh.

A. P. JENKS, assistant to vice-president of the J. G. Brill Company, with headquarters at Chicago, will be placed in charge of gas-electric car sales in the Chicago territory, following the resignation of A. F. McCormick, sales agent, who will become a representative of the Grinnell Company, Grinnell, Iowa, effective June 30.

THE PYLE-NATIONAL COMPANY, Chicago, has acquired as a subsidiary to its organization The Electro-Chemical Engineering Corporation, Chicago. This company is engaged in the manufacture of boiler signal foam-meters with electromatic blow-off and boiler corrosion prevention equipment. The same personnel will be retained in the subsidiary organization.

CHAMP CARRY, vice-president of the Pullman Car & Manufacturing Corp., has been elected vice-president and assistant to the president of the Pullman Company. Mr. Carry was born in Lockport, Ill., and was educated at Cornell University. In 1918, he entered an officers' training camp, and was commissioned first lieutenant in the Eighteenth Field Artillery, Third Division. While in France, he was awarded a distinguished service cross. After the war, in 1919, he was appointed sales agent for the Haskell & Barker Car Co., and when this company was taken over by the Pullman Company in 1922, he became sales agent for the latter company. In 1924, upon the organization of the Pullman Car & Manufacturing Corp., he was appointed sales manager, which position he held until December 24, 1929, when he was elected vice-president. With his election as vice-president of the Pullman Company, Mr. Carry relinquishes his duties with the Car Company.

GEORGE P. NICHOLS & BROTHER, Chicago, have acquired all the physical assets, equipment, patents and good will of the Stearns-Stafford Roller Bearing Company, Lawton, Mich., and will carry on the manufacture and sale of that company's products through the Stearns-Stafford Roller Bearing Division of George P. Nichols & Bro., Inc. The Nichols organization, started in 1894, was a partnership formed by George P. Nichols and Samuel F. Nichols which continued until 1928, when George P. Nichols retired on account of ill health. In 1900 the organization began the manufacture of transfer tables and electric turntable tractors and their equipment is now used on many railroads in the United States and Canada. The Stafford Roller Bearing Car Truck Corporation, which later became the Stearns-Stafford Roller Bearing Company, was organized in 1920 and was one of the pioneers in the application of roller bearings to railroad rolling stock, and a pioneer in the application of roller bearings to scale test cars and to turntable trucks in the conversion to three-point suspension. A new corporation, George P. Nichols & Bro., Inc., supplants the former partnership and proposes to cover the field of bearings for rolling stock and turntables and equipment in heavy industrial service. They have acquired the patent rights on a split axle, equipped completely with roller bearings designed to save power and reduce the wear on wheels and track. The general office and factory will remain at 2139 Fulton street, Chicago. The manufacture of roller bearings will be carried on for the present at Lawton, Mich.

THE WAUGH EQUIPMENT COMPANY with general headquarters at Depew, N. Y., and the Firebar Corporation, Cleveland, Ohio, have been merged. The present name of the Waugh Equipment Company will be continued as the name of the consolidated corporation. J. S. Thompson, president of the former Firebar Corporation, has been elected chairman of the board and A. J. Pizzini, president of the Waugh Equipment Company, continues as president of the new corporation. R. J. O'Brien has been elected executive vice-president and H. A. Ransom, W. M. Roche, and M. P. Van Wert have been elected vice-presidents. The executive headquarters and sales offices will continue in New York City. Sales offices will be maintained in Chicago, St. Louis, Mo., Cleveland, Ohio, and Montreal, Que., with general offices, laboratories, etc., at Depew, N. Y. The Firebar Corporation was organized some three years ago.

Obituary

F. F. LANDIS, one of the founders of the Landis Tool Company, Waynesboro, Pa., died on Monday, May 2.

E. B. WILSON, vice-president and general manager of the Gold Car Heating & Lighting Company, Brooklyn, N. Y., died on May 31, in a hospital at East Orange, N. J.

EDWARD B. LEIGH, president of the Chicago Railway Equipment Company, Chicago, died on May 17 at his ranch in Center Point, Kerr county, Tex. Mr. Leigh was born in Townsend, Mass., on April 13, 1853, and at the age of 15 entered the employ of the Pennsylvania in the offices at St. Louis, Mo. In 1875 he left the employ of the railroad to become assistant secretary of the St. Louis Grain Elevator Company, which position he held until 1882, when he re-entered the railway field as manager of the American Brake Company which later was absorbed by the Westinghouse Air Brake Company. In 1887 he organized the National Hollow Brake Beam Company to make and distribute a metal trussed brake beam. In 1892, in order to broaden his activities,

Edward B. Leigh

he organized the Chicago Railway Equipment Company, which took over the business of the National Hollow Brake Beam Company, the American Brake Beam Company and other companies. From the beginning, Mr. Leigh filled the office of vice-president and general manager and in 1906 was elected president, the position he was holding at the time of his death. Apart from his immediate business interests, but springing from them, Mr. Leigh devoted much time, thought and energy to the many problems and to the complex conditions surrounding and af-

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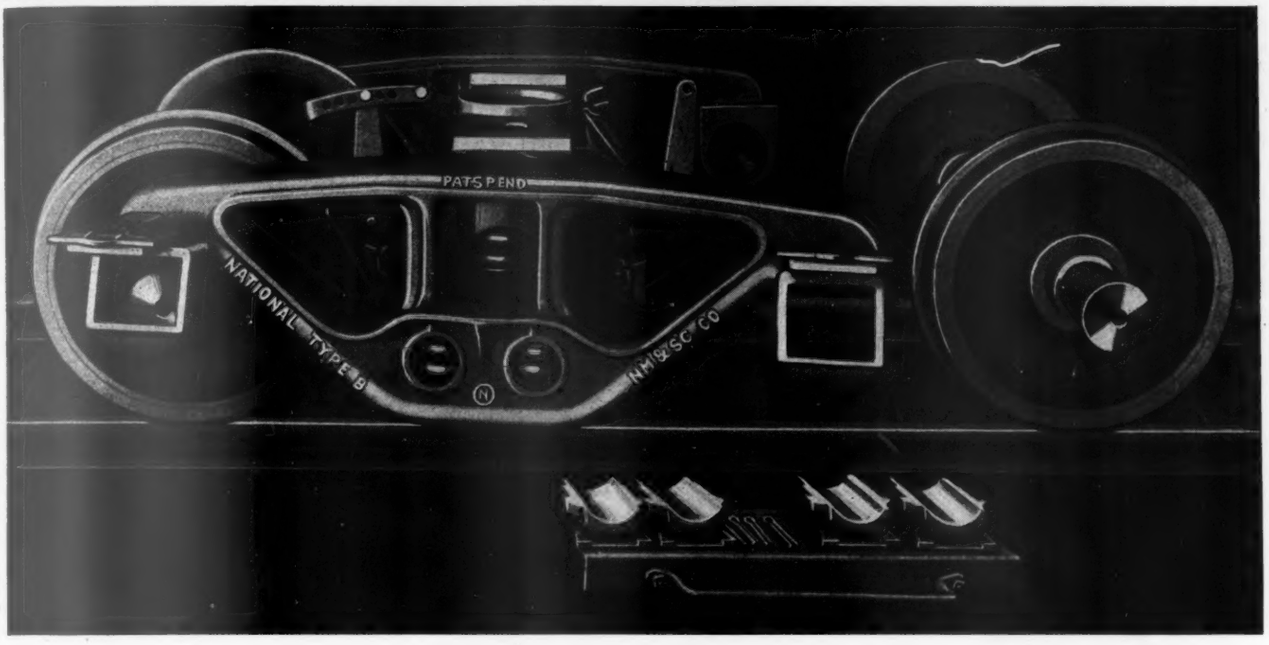
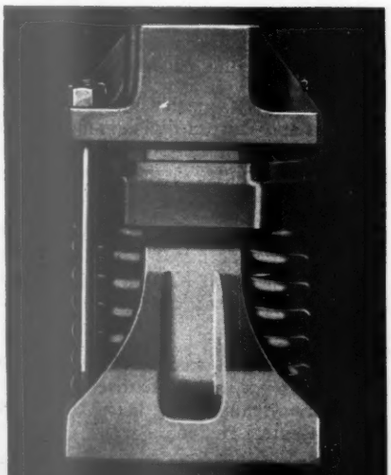
TRUCKS ››› that Speed Train Operation



SIMPLIFIED DESIGN SPEEDS MAINTENANCE WORK



M17
National Draft Gear
Another contribution by National to profitable freight operation. This gear stands first in the combination of capacity, sturdiness and endurance.

NATIONAL Type B trucks represent the latest step in simplification of design. By improved design the number of individual parts has been substantially reduced — maintenance work is cut down and easy accessibility to permit quick wheel change is obtained.

These, together with other important advantages such as increased strength, less weight and greater spring capacity, are obtained in National Type B trucks without any premium in cost.

NATIONAL MALLEABLE AND STEEL CASTINGS CO.
General Offices: CLEVELAND, OHIO

Sales Offices: New York, Philadelphia, Washington, Chicago, St. Louis, San Francisco
Works: Cleveland, Chicago, Indianapolis, Sharon, Pa., Melrose Park, Ill.

NATIONAL
TYPE (NM&SC) ··B··
TRUCKS

fecting industry in general, especially to such as bear upon the great railway systems of the country. Throughout his career he had been active in various associations, having been a charter member and a director of the Railway Business Association and a director of the National Association of Manufacturers and a member of the National Industrial Conference Board.

GILBERT E. RYDER, vice-president of the Superheater Company, New York, died at his home at Larchmont, N. Y., on May 17 of heart failure. Mr. Ryder was born May 29, 1880, at Minneapolis, Minn. He was educated in the public Schools of Sandwich, Ill., also at Tabor Academy, Marion, Mass., the University of Wisconsin and the University of Illinois. He began work as a special apprentice with the Chicago, Milwaukee & St. Paul, now the Chicago, Milwaukee, St. Paul & Pacific, and subsequently served consecutively as machinist and draftsman on that road; assistant mechanical engineer of

Gilbert E. Ryder

the Briquette division, United States Geological Survey, Technical Branch; deputy smoke inspector of the City of Chicago; and associate editor of the Railway Review. In December, 1911, Mr. Ryder entered the service of the Superheater Company, New York, as a service engineer; he was subsequently appointed assistant to vice-president and in 1921 was elected vice-president in charge of sales and service. Mr. Ryder was a member of a number of technical societies, including: The American Society of Mechanical Engineers; the International Railway Supply Men's Association, with which he served as committee chairman, member of the executive committee, vice-president and president (in connection with the Railway Fuel Association); the Railway Equipment Manufacturer's Association (in connection with the Traveling Engineers' Association). He served as president of the Railway Supply Manufacturers' Association for the years 1929 and 1930. Mr. Ryder also took a keen interest in civic and educational affairs. He was the author of a number of papers on superheated steam presented before railway clubs and published in technical magazines.

DONALD M. RYERSON, chairman of the board of Jos. T. Ryerson & Son, Inc., died suddenly at Lake Forest, Ill., on May 8. Mr. Ryerson was born in Chicago on December 2, 1884, and was graduated from Yale University in 1907. He entered the employ of the Ryerson company as vice-president and general manager, which position he held until 1928, when he was elected chairman of the board to succeed his father, Edward L. Ryerson, Sr., who died in January of that year. Besides his connection with the Ryerson firm, he was president of the Reed-Smith Company, an affiliated company. During the World War he was engaged for a time in supervising the construction of submarine chasers at the plant of the Great Lakes Boat Building Corp., and later was originator of the "Four-Minute Men," an organization of patriotic speakers who functioned during the Liberty Loan drives. He was sent to the U. S. Naval Academy to attend the first reserve officers class with the rank of ensign in 1917, and resigned after attaining the rank of lieutenant in overseas destroyer service.

EDMUND H. WALKER, former president of the Standard Coupler Company, died suddenly at New York on May 31, at the age of 60. Mr. Walker before entering the railway supply field served in various departments on the Great Northern, the Atchison, Topeka & Santa Fe, the Chicago, Burlington & Quincy and the Minneapolis, St. Paul & Sault Ste. Marie. He went with the Standard Coupler Company in February, 1905, and later was

Edmund H. Walker

made first vice-president. He was elected president of the company in January, 1921. Subsequently he left that company to organize the Walker Draft Gear Company and in 1927, when its business was taken over by the Bradford Corporation, New York, he became a vice-president of the latter corporation, with headquarters at New York, remaining with that company until about a year ago. He was president of the Railway Supply Manufacturers' Association for the years 1917, 1918 and 1919, and was active also in civic affairs in East Orange, N. J., serving for several years as president of the board of education of that city.

Personal Mention

General

J. L. CARVER, engineer of tests of the Illinois Central, has moved his headquarters from the Burnside shops, Chicago, to Paducah, Ky.

P. M. SULLIVAN, acting superintendent of motive power and cars of the Duluth, Missabe & Northern, with headquarters at Proctor, Minn., has been appointed superintendent of motive power and cars.

Master Mechanics and Road Foremen

A. W. BYRON, superintendent of motive power of the Pennsylvania, has been appointed master mechanic, with headquarters at Williamsport, Pa.

B. W. JOHNSON, assistant road foreman of engines of the Williamsport division of the Pennsylvania, has been transferred to the Baltimore division.

J. T. LEACH, master mechanic of the Pennsylvania at Juniata, Pa., has been appointed master mechanic of the Middle division.

A. LAMAR, master mechanic on the Williamsport division of the Pennsylvania, has been transferred to the Western Region.

H. B. CHAFFIN, master mechanic of the Middle division of the Pennsylvania, has been appointed master mechanic of the Eastern division.

J. A. WARREN, road foreman of engines of the Sunbury division of the Pennsylvania, has been appointed road foreman of engines of the Indianapolis division.

M. J. BROWN, master mechanic of the Chicago and Aurora divisions of the Chicago, Burlington & Quincy at Chicago, has been appointed assistant master mechanic at the same point.

R. H. TAIT, master mechanic of the Kansas City Terminal Division of the Missouri Pacific at Kansas City, has been appointed assistant master mechanic at the same point.

W. H. SMITH, assistant road foreman of engines of the Baltimore division of the Pennsylvania, has been transferred to the Central region.

H. C. VINSANT, general foreman of the Texas & Pacific at Fort Worth, Tex., has been promoted to the position of assistant master mechanic, with headquarters at Fort Worth.

E. J. MCSWEENEY, district master mechanic of the Southwest district of the Baltimore & Ohio, has been appointed master mechanic of the St. Louis division and the Cincinnati Terminal division, with headquarters as before at Cincinnati, Ohio.

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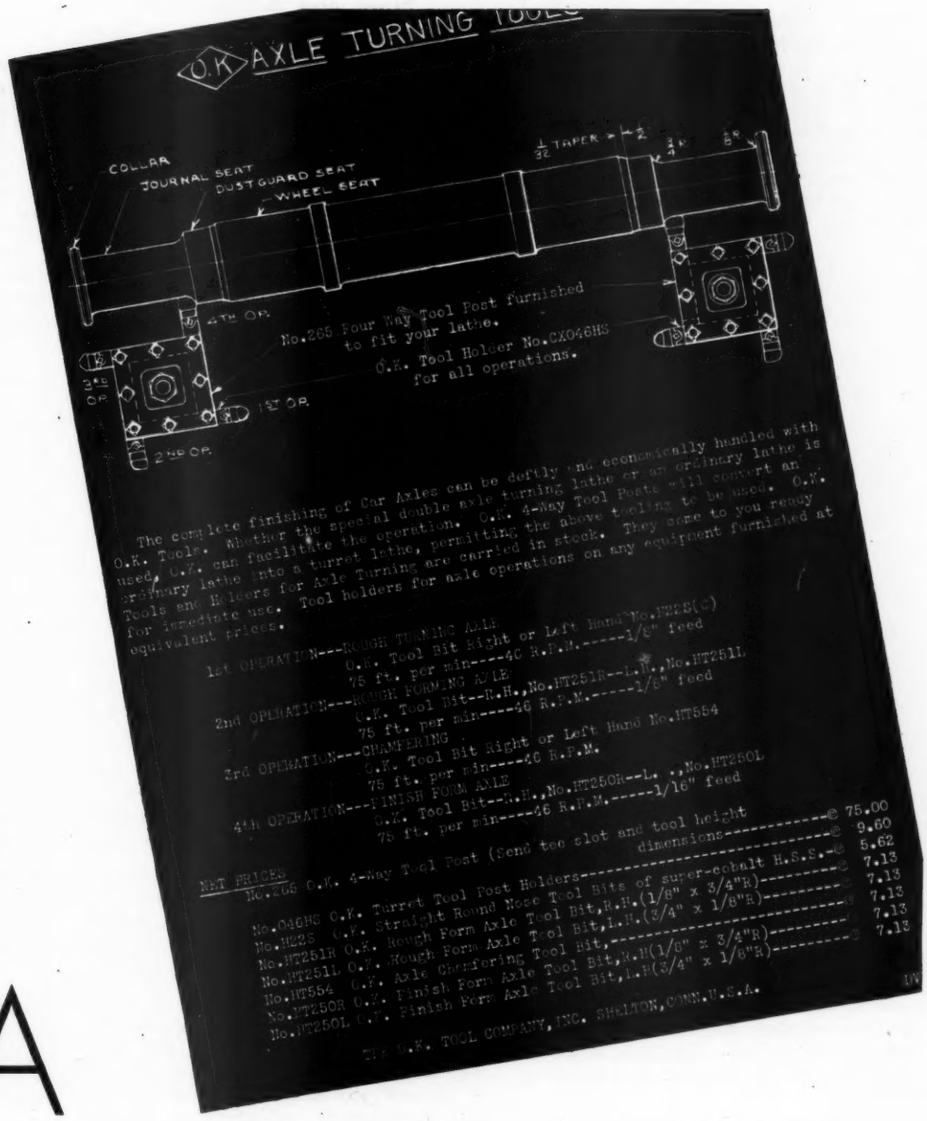
O.K. AXLE TURNING TOOLS
COLLAR
JOURNAL SEAT
DUST GUARD SEAT
WHEEL SEAT
No.265 Four Way Tool Post furnished to fit your lathe.
O.K. Tool Holder No.CX046HS for all operations.
The complete finishing of Car Axles can be deftly and economically handled with O.K. Tools. Whether the special double axle turning lathe or an ordinary lathe is used, O.K. can facilitate the operation. O.K. 4-Way Tool Posts will convert an ordinary lathe into a turret lathe, permitting the above tooling to be used. O.K. Tools and Holders for Axle Turning are carried in stock. They come to you ready for immediate use. Tool holders for axle operations on any equipment furnished at equivalent prices.
1st OPERATION---ROUGH TURNING AXLE
O.K. Tool Bit Right or Left Hand No.HT228(C)
75 ft. per min----40 R.P.M.----1/8" feed
2nd OPERATION---ROUGH FORMING AXLE
O.K. Tool Bit--R.H.,No.HT251R--L.H.,No.HT251L
75 ft. per min----46 R.P.M.----1/8" feed
3rd OPERATION---CHAMFERING
O.K. Tool Bit Right or Left Hand No.HT554
75 ft. per min----46 R.P.M.
4th OPERATION---FINISH FORM AXLE
O.K. Tool Bit--R.H.,No.HT250R--L.H.,No.HT250L
75 ft. per min----46 R.P.M.----1/16" feed
NET PRICES
No.266 O.K. 4-Way Tool Post (Send toe slot and tool height dimensions)----------@ 75.00
No.046HS O.K. Turret Tool Post Holders----------@ 9.60
No.H22S O.K. Straight Round Nose Tool Bits of super-cobalt H.S.S.----@ 5.62
No.HT251R O.K. Rough Form Axle Tool Bit,R.H.(1/8" x 3/4"R)----------@ 7.13
No.HT251L O.K. Rough Form Axle Tool Bit,L.H.(3/4" x 1/8"R)----------@ 7.13
No.HT554 O.K. Axle Chamfering Tool Bit,----------@ 7.13
No.HT250R O.K. Finish Form Axle Tool Bit,R.H(1/8" x 3/4"R)----------@ 7.13
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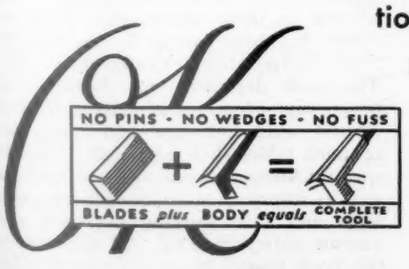
THE O.K. TOOL COMPANY,INC. SHELTON,CONN.U.S.A.

RED HOT DATA

~on tool *savings* . . . .

Here is a source of real information... data sheets based on actual results obtained in railroad shop operations through the application of O.K. Inserted Blade Tools. No guess work... no ballyhoo... just meaty information. The above small reproduction of one of the sheets describes axle turning tools with layout suggestion. Additional sheets covering many specialized operations will be mailed *free on request*. Sheets are now available describing wheel turning, milling cross head shoes, trepanning, etc. SEND FOR THEM NOW! No obligation whatsoever!



THE O. K. TOOL CO., INC. *Shelton, Conn.*

ORIGINAL RESEARCH · SKILLED ENGINEERING · COMPLETE FACILITIES · FIELD INSPECTION

C. L. EMERSON, master mechanic of Chicago, Milwaukee, St. Paul & Pacific, at Chicago, has had his jurisdiction extended to include the Terre Haute division.

E. R. HANNA, master mechanic of the Arkansas division of the Missouri Pacific, with headquarters at Little Rock, Ark., has had his jurisdiction extended to include the Missouri division.

J. J. PRENDERGAST has been appointed master mechanic of the Fort Worth division of the Texas & Pacific, with head-

J. J. Prendergast

quarters at Fort Worth, Tex. A sketch of Mr. Prendergast's career appeared in the May issue of the *Railway Mechanical Engineer*.

THE JURISDICTION of C. R. Kilbury, master mechanic of the Omaha and Northern Kansas divisions of the Missouri Pacific at Falls City, Neb., has been extended over the Kansas City Terminal division.

W. D. JOHNSTON, district master mechanic of the Northwest district of the Baltimore & Ohio, Western lines, with headquarters at Cincinnati, Ohio, has had his jurisdiction extended over the Southwest district.

G. P. TRACHTA, master mechanic of the La Crosse division of the Chicago, Burlington & Quincy, with headquarters at North La Crosse, Wis., has been transferred to Galesburg, to succeed H. C. Gugler.

H. C. GUGLER, master mechanic of the Galesburg division of the Chicago, Burlington & Quincy, with headquarters at Galesburg, Ill., has been transferred to Chicago, where he has jurisdiction over the Chicago, Aurora and La Crosse divisions.

G. E. PASSAGE, master mechanic of the Terre Haute division of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Terre Haute, Ind., has been transferred to the Hastings & Dakota division, with headquarters at Aberdeen, S. D.

Shop and Enginehouse

C. J. RICHERS, master mechanic of the Pennsylvania at Mt. Carbon, Pa., has been appointed foreman.

C. H. REYNOLDS, assistant foreman at the East Altoona (Pa.) enginehouse of the Pennsylvania, has been appointed enginehouse foreman at Elmira, N. Y.

H. D. CARPENTER, assistant master mechanic of the Philadelphia division of the Pennsylvania, has been appointed enginehouse foreman, with headquarters at Hagerstown, Md.

A. W. SUMNER, assistant master mechanic of the middle division of the Pennsylvania, has been appointed enginehouse foreman, with headquarters at York, Pa.

E. F. MASON, assistant master mechanic of the Elmira division of the Pennsylvania, has been appointed enginehouse foreman, with headquarters at Canandaigua, N. Y.

Purchases and Stores

G. E. Hall has been appointed assistant general storekeeper of the Canadian Pacific, Western lines, with headquarters at Winnipeg, Man.

R. E. KELLY, storekeeper of the Chicago, Burlington & Quincy at Galesburg, Ill., has been transferred to the Ottumwa division, with headquarters at West Burlington, Iowa.

J. K. MCCANN, storekeeper of the Chicago, Burlington & Quincy at St. Joseph, Mo., has been transferred to the Creston division with headquarters at Creston, Iowa.

U. K. HALL, general supervisor of stores of the Union Pacific System, has been appointed to the newly-created position of general storekeeper for the system, with headquarters as before at Omaha, Neb.

Obituary

GODFREY W. RHODES, who retired in May, 1905, after 25 years of service in the mechanical and operating departments of the Burlington system, died at his home in Bergerville, Que., on April 27, at the age of 82. Mr. Rhodes entered the service of the Burlington system about 1880 and in 1888 was made superintendent motive power of the Chicago, Burlington & Quincy. Early in 1899 he was appointed assistant general superintendent of the Burlington & Missouri River Railroad. In September, 1904, the C. B. & Q. lines west of the Missouri river were divided into two districts and Mr. Rhodes became general superintendent of the Wyoming district, which position he held until his retirement in 1905. In the late 80's and the 90's he was one of the most active members of the American Railway Master Mechanics' Association and the Master Car Builders Association. He was also actively identified with the Western Railway Club in various capacities.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers. State the name and number of the bulletin or catalog desired, when mentioned in the description.

TRANSMISSION BELTING.—The Garlock Packing Company, Palmyra, N. Y., has issued a 20-page booklet descriptive of Garlock transmission belting which is of duck and rubber composition.

DROP FORGINGS AND DROP-FORGED TOOLS.—The new pocket size catalog of 215 pages issued by J. H .Williams & Company, 75 Spring street, New York, describes and illustrates the "Superior" line of drop forgings and drop-forged tools which include general forgings, machinists tools, toolholders, pipe fitters tools, wrenches, etc.

CAR COOLING EQUIPMENT.—Two systems of passenger-car cooling—one using ice as the cooling medium, the other cooling by mechanical refrigeration—are described and illustrated in catalog No. 388 issued by the B. F. Sturtevant Company, Hyde Park, Boston, Mass. The ductless method of air distribution for both methods of cooling is also featured in this catalogue.

RUBBER.—"A Wonder Book of Rubber," published by The B. F. Goodrich Company, Akron, Ohio, is a story of rubber and the manufacture and use of rubber products. It has been written to provide general information about the rubber industry and is attractively illustrated. There are chapters on crude rubber, textiles in rubber, preparing rubber for manufacture, manufacturing operations, etc., also an outline of the Goodrich organization.

ROLLER BEARINGS.—"Definite Control of Quality" is the title of an attractive anniversary book issued by the Hyatt Roller Bearing Company, Harrison, N. J., in which are shown the standard types of Hyatt bearings, together with various highlights on material control, bearing production, inspection, the plant and personnel. The book has a cover of blue embossed in gold, and its pages are 10 in. by 11 in., printed in black on a tan and white background. The company was established in 1892.

REPUBLIC ELECTRIC WELD LINE PIPE CASING.—An attractive 36-page book, printed in three colors—red, black and silver—has been issued by the Republic Steel Corporation, Youngstown, Ohio. The book describes and illustrates the progressive processes of making Republic electric weld line pipe and casing and contains tables showing weight, diameter, wall thickness and mill test standards, as well as information on threads and couplings and safe working pressures with various safety factors. All requests for this book should be made on business letterheads.